

**ENERGY SAVINGS OPPORTUNITY SURVEY  
FORT BELVOIR, ALEXANDRIA, VIRGINIA**

**A/E CONTRACT NO.  
DACA 31-89-C-0198**

**FINAL SUBMITTAL  
VOLUME IV**

**Calculations**

**Prepared for**

**DEPARTMENT OF THE ARMY  
BALTIMORE DISTRICT CORPS OF ENGINEERS  
BALTIMORE, MARYLAND**

**[DTIC QUALITY INSPECTED 2]**

**19971017 180**

**By**

**ENGINEERING APPLICATIONS CONSULTANTS  
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BURKE, VIRGINIA 22015-1630**

**August 1991**

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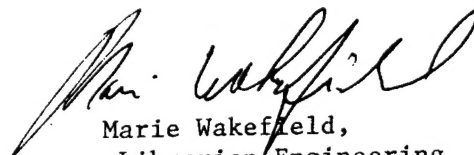


DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
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Marie Wakefield,  
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**VOLUME IV**  
**CALCULATIONS**

**Building 505A**

**Building 1359**

**Buildings 1-60 (General Officers' Quarters)**

**Buildings 401-432 (Rossell Village)**

**Buildings 900-944 (Dogue Creek Village)**

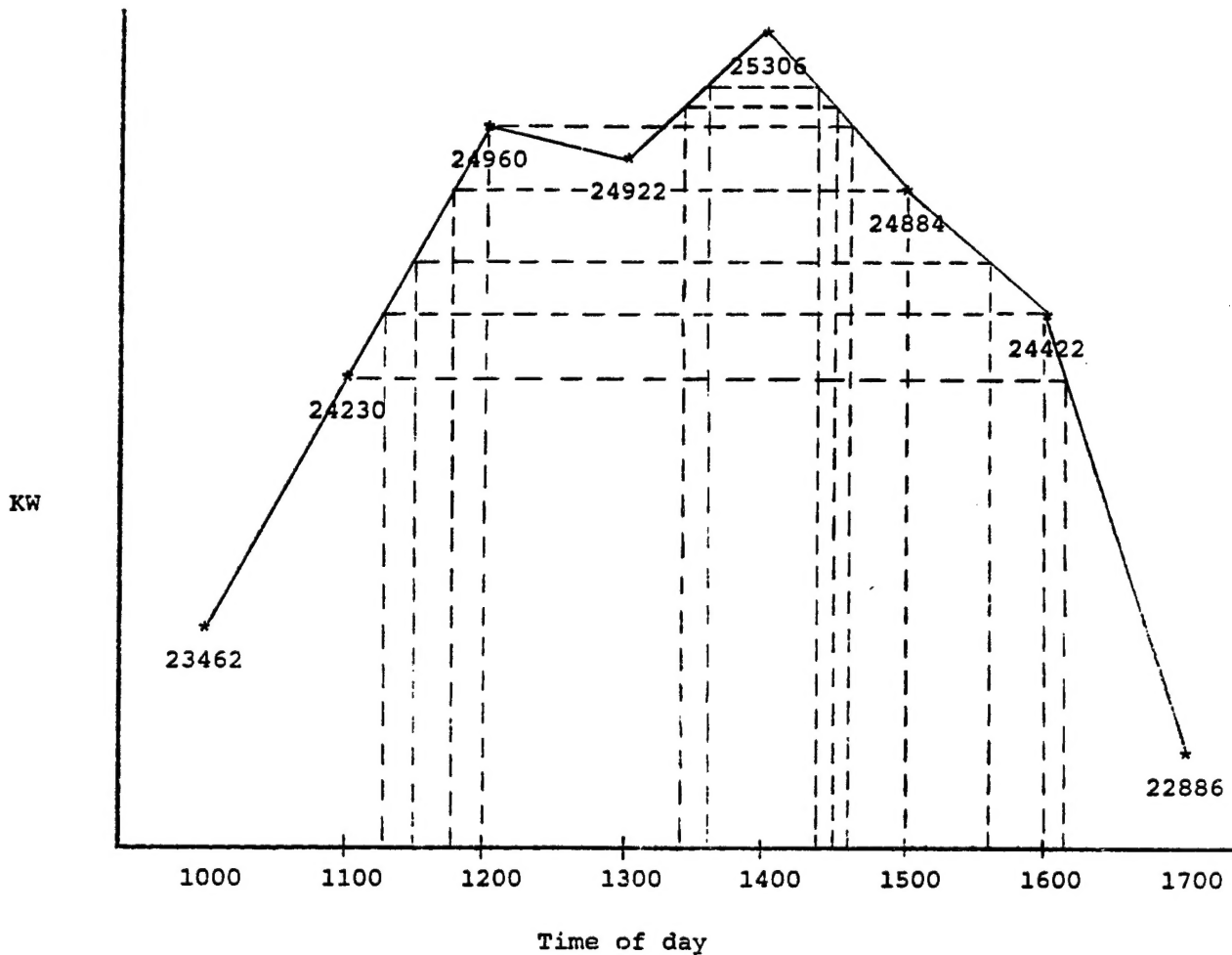
**Buildings 2600-2787 (Woodlawn Village)**

BUILDING 505A

## ELECTRICAL PEAK DEMAND

FORT BELVOIR

Peak Day Of July 11, 1989



## ESTIMATED ELECTRICAL BILLING DEMAND WHEN USING A GENERATOR

TIME OF DAY GENERATOR ON	KW DEMAND SAVED	GENERATOR HOURS/DAY	ESTIMATED TOTAL BILLING KW DEMAND
1100-1615	1076	5.3	24,230
1110-1600	884	4.8	24,422
1130-1540	614	4.2	24,692
1140-1535	500	3.9	24,806
1150-1500	422	3.2	24,884
1310-1445	346	1.6	24,960
1315-1430	270	1.3	25,036
1330-1420	154	0.8	25,152

FORT BELVOIR KW DEMAND  
SUMMER OF 1989

PEAK DAY OF JULY 11, 1989  
30 MINUTE DEMANDS

TIME	KW DEMAND
----	-----
0030	16,666
0100	16,358
0130	16,012
0200	15,706
0230	15,514
0300	15,360
0330	15,168
0400	15,092
0430	14,976
0500	15,014
0530	15,322
0600	15,706
0630	16,090
0700	17,510
0730	18,816
0800	20,006
0830	21,082
0900	22,042
0930	22,772
1000	23,462
1030	23,846
1100	24,230
1130	24,692
1200	24,960
1230	24,806
1300	24,922
1330	25,152
1400	25,306 * Peak
1430	25,036
1500	24,884
1530	24,844
1600	24,422
1630	23,654
1700	22,886
1730	22,042
1800	21,696
1830	21,428
1900	21,082
1930	20,928
2000	20,620
2030	20,428
2100	20,276
2130	20,084
2200	19,276
2230	18,508
2300	17,894
2330	17,396
2400	16,896

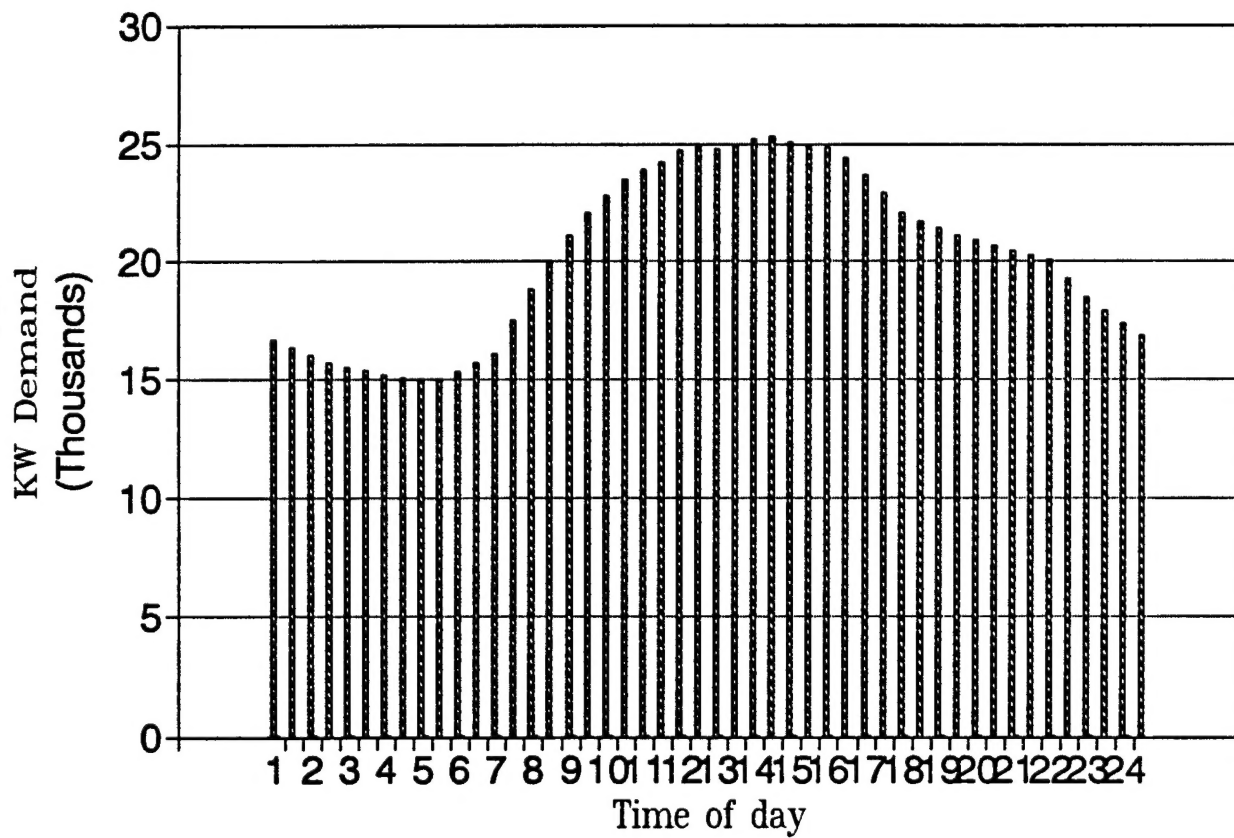
FORT BELVOIR KW DEMAND  
SUMMER OF 1989

PEAK DAY OF JULY 11, 1989  
HOURLY DEMANDS

TIME ----	KW DEMAND -----
0100	16,358
0200	15,706
0300	15,360
0400	15,092
0500	15,014
0600	15,706
0700	17,510
0800	20,006
0900	22,042
1000	23,462
1100	24,230
1200	24,960
1300	24,922
1400	25,306 * Peak
1500	24,884
1600	24,422
1700	22,886
1800	21,696
1900	21,082
2000	20,620
2100	20,276
2200	19,276
2300	17,894
2400	16,896

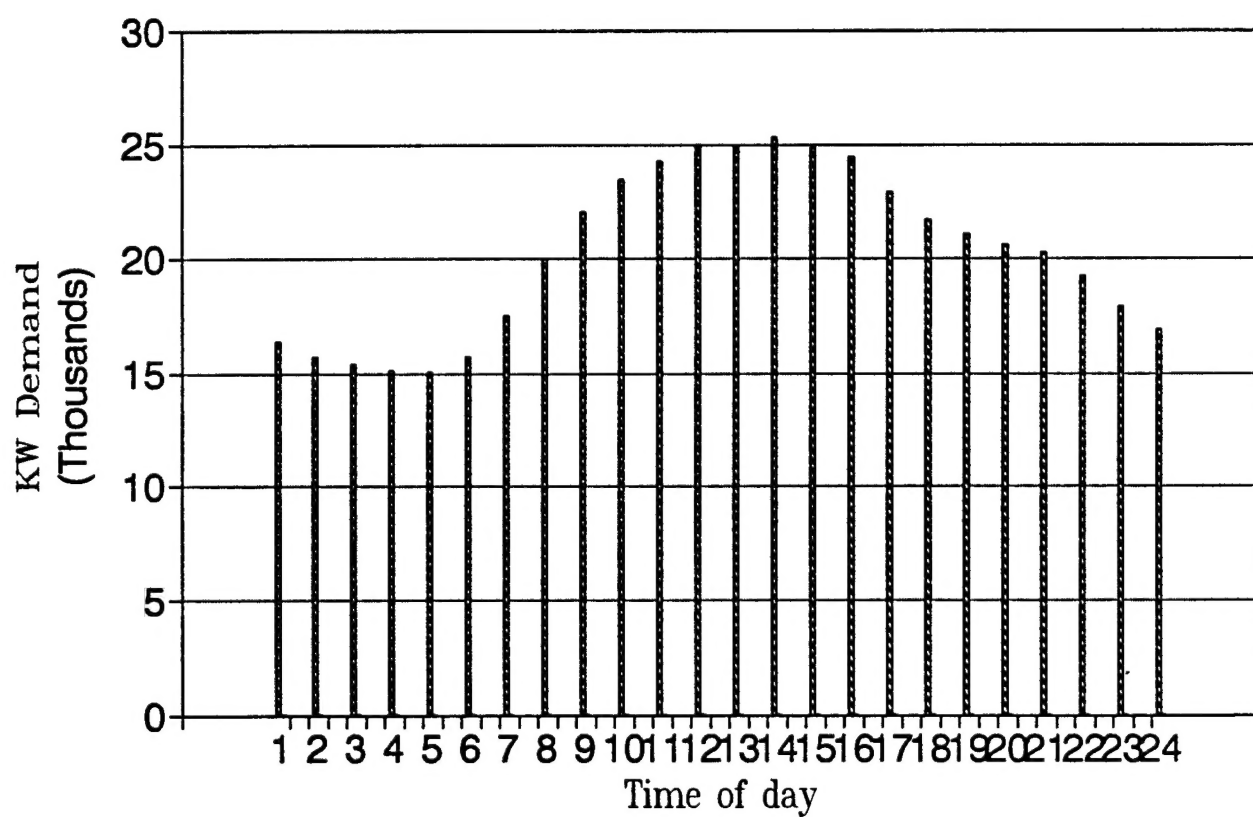
# Electrical Peak Demand

## Fort belvoir



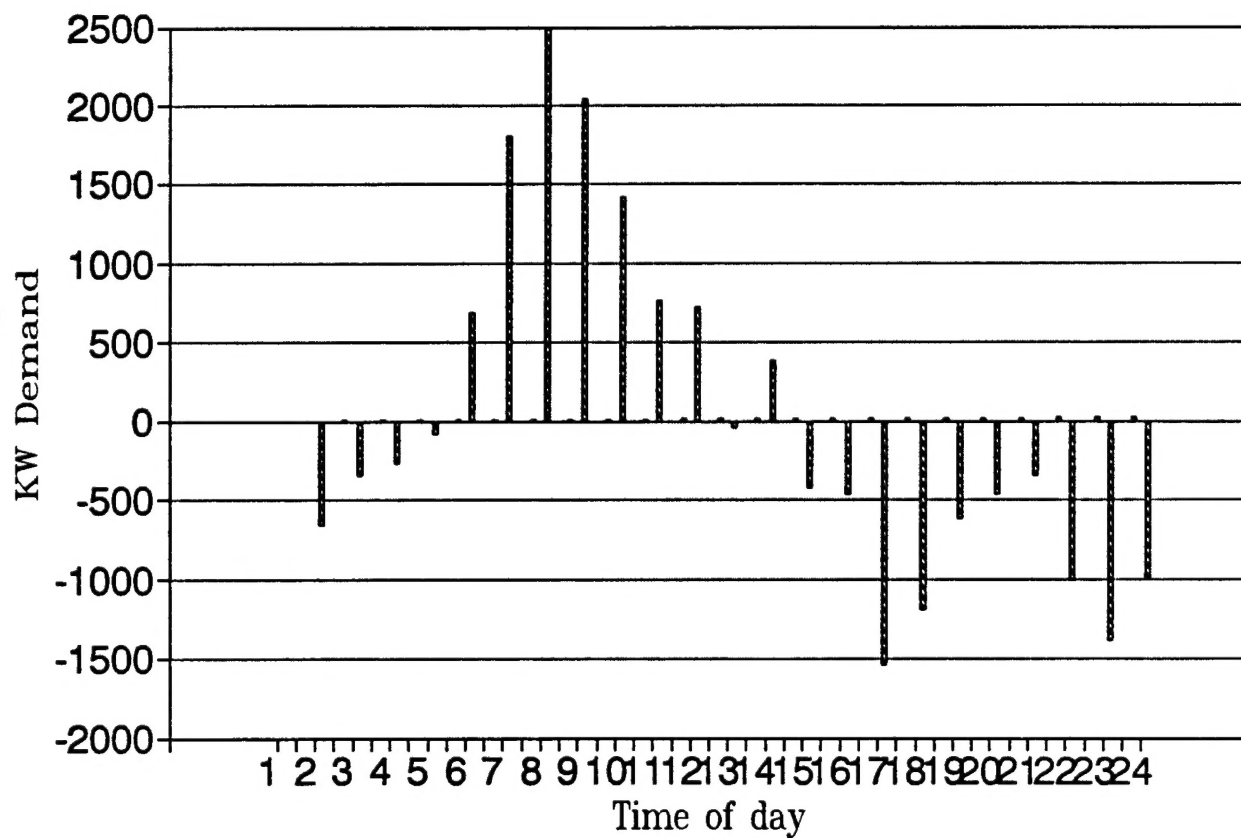
# Electrical Peak Demand

## Fort Belvoir



# Incremental Peak Demand

## Fort Belvoir





ELECTRICAL PEAK DEMANDS  
FORT BELVOIR

	1989	1990
HIGHEST BILLING PEAK KW DEMAND:	25,306 KW (July)	28,735 KW (July)
HIGHEST BILLING TOTAL MONTHLY KWH:	11,168,000 KWH (July)	14,868,000 KWH (July)
HOURS USE OF MAXIMUM DEMAND:	441.3 HOURS	517.4 HOURS

ELECTRICAL PEAK DEMANDS  
SUBSTATION 505 A

TOTAL CALCULATED PEAK DEMAND FOR SUBSTATION 505 A:      3219 KW

ESTIMATED KW LOAD AVAILABLE AT SUBSTATION 505 A

CIR NO.	KWH (July) 1989	KWH (July) 1990	ESTIMATED 1989 PEAK LOAD (KW)	ESTIMATED 1990 PEAK LOAD (KW)	ESTIMATED AVERAGE PEAK LOAD (1989 & 1990)
CIR. 3	161,400	158,880	366	307	336
CIR. 5	209,400	200,400	474	387	431
CIR. 6	401,600	376,000	910	727	818
CIR. 7	262,400	284,800	595	550	573
CIR. 8	184,000	193,000	417	373	395

Note: The presented circuits are the circuits where metering data is available

# SUBSTATION 505 A

## EXPECTED COINCIDENTAL KW DEMAND AVAILABLE AT SUBSTATION 505 A

CIR NO.	ESTIMATED AVERAGE PEAK LOAD (KW)	ESTIMATED AVAILABLE COINCIDENTAL KW (Diversified)	GENERAL AREA SERVED
CIR. 3	336	269	0-90 Area
CIR. 5	431	345	200 Area
CIR. 6	818	655	400 Area
CIR. 7	573	458	0-90 Area
CIR. 8	395	316	500 Area

## GENERATOR SERVING SINGLE CIRCUITS

PEAK KW	CIRCUIT NUMBER	GENERATOR SIZE (KW)	TIME OF DAY GENERATOR ON	GENERATOR HOURS/DAY	KWH GENERATED PER MONTH
366	3	600	1310-1430	1.4	9,018
474	5	750	1305-1450	1.8	15,016
910	6	1500	1120-1545	4.4	70,470
595	7	1000	1135-1530	3.9	40,841
417	8	750	1310-1445	1.6	11,743

## GENERATOR SERVING MULTIPLE CIRCUITS

PEAK KW	CIRCUIT NUMBER	GENERATOR SIZE (KW)	TIME OF DAY GENERATOR ON	GENERATOR HOURS/DAY	KWH GENERATED PER MONTH
803	3+8	1100	1130-1535	4.1	57,944
840	3+5	1200	1125-1540	4.3	63,571
911	8+5	1250	1120-1545	4.4	70,548
1011	3+7	1500	1115-1550	4.6	81,851
1082	8+7	1500	1110-1555	4.7	89,503
1119	5+7	1500	1105-1600	4.8	94,533

Note: Generators larger than 1500 kw have not been evaluated

NATURAL GAS GENERATORS FOR PEAK DEMAND REDUCTION - SUBSTATION 505 A  
FORT BELVOIR

## JULY DEMAND

SUB. 505 A CIRCUIT NUMBER	ESTIMATED PEAK LOAD	TOTAL FT BELVOIR MAXIMUM POSSIBLE DEMAND REDUCTION	NATURAL GAS GENERATOR NOMINAL SIZE
-----	-----	-----	-----
3	366 KW	269 KW	630 KW
5	474 KW	345 KW	780 KW
6	910 KW	655 KW	1720 KW
7	595 KW	458 KW	1055 KW
8	417 KW	316 KW	630 KW

## HOURS OF GENERATION

CIRCUIT NUMBER	START TIME	END TIME	HOURS/DAY	HOURS/MONTH	TOTAL HOURS PER SUMMER
-----	-----	-----	-----	-----	-----
3	1310	1435	1.4	31	123
5	1300	1450	1.8	40	158
6	1120	1545	4.4	97	387
7	1140	1535	3.9	86	343
8	1310	1445	1.6	35	141

## KWH GENERATED

CIRCUIT NUMBER	KWH PER MONTH	TOTAL KWH PER SUMMER	TOTAL MBTU SAVED	DEMAND SAVED	GENERATOR SIZE (KW)
-----	-----	-----	-----	-----	-----
3	9,018	36,073	123.1	269	630
5	15,016	60,065	205.0	345	780
6	70,470	281,882	962.1	655	1720
7	40,841	163,363	557.6	458	1055
8	11,743	46,971	160.3	316	630

## ENERGY SAVINGS

## DEMAND SAVINGS

## TOTAL

CIRCUIT NUMBER	KWH \$ SAVED PER MONTH	KWH \$ SAVED PER SEASON	DEMAND SAVED/MONTH SUMMER	DEMAND SAVED/MONTH WINTER	TOTAL ANNUAL DEMAND SAVED	ANNUAL SAVINGS
-----	-----	-----	-----	-----	-----	-----
3	\$195	\$779	\$2,900	\$2,610	\$32,478	\$33,257
5	\$324	\$1,297	\$3,719	\$3,347	\$41,654	\$42,951
6	\$1,522	\$6,089	\$7,061	\$6,355	\$79,082	\$85,171
7	\$882	\$3,529	\$4,937	\$4,444	\$55,297	\$58,826
8	\$254	\$1,015	\$3,406	\$3,066	\$38,153	\$39,167

## NATURAL GAS GENERATORS FOR PEAK DEMAND REDUCTION - SUBSTATION 505 A

## GENERATING COSTS PER MONTH

CIRCUIT NUMBER	GENERATOR SIZE	GENERATOR CCF/HR	GENERATOR HOURS	ELECTRIC KWH REDUCE	THERMS USED	MBTU GEN./MO.	GENERATING COSTS/MO
3	630	74	31	9,018	1,324	136.5	\$1,364
5	780	83	40	15,016	1,997	205.9	\$2,057
6	1720	195	97	70,470	9,987	1029.6	\$10,286
7	1055	121	86	40,841	5,855	603.7	\$6,031
8	630	74	35	11,743	1,724	177.8	\$1,776

## CAPITAL RECOVERY COSTS

CIRCUIT NUMBER	TOTAL SUMMER HOURS	GENERATOR ESTIMATED LIFE	GENERATOR SIZE	TOTAL COST	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY COSTS/YR
3	123	25	630	\$350,814	0.08776	\$30,787
5	158	25	780	\$477,302	0.08776	\$41,888
6	387	25	1720	\$1,044,131	0.08776	\$91,633
7	343	25	1055	\$735,118	0.08776	\$64,514
8	141	25	630	\$350,814	0.08776	\$30,787

## TOTAL ANNUAL GENERATOR COSTS

CIRCUIT NUMBER	GENERATING COSTS	OPERATING COSTS	MAINTEN. COSTS	CAPITAL COSTS	TOTAL ANNUAL GENERATOR COSTS
3	\$5,455	\$4,558	\$361	\$30,787	\$41,162
5	\$8,229	\$5,861	\$601	\$41,888	\$56,579
6	\$41,145	\$14,326	\$2,819	\$91,633	\$149,923
7	\$24,123	\$12,698	\$1,634	\$64,514	\$102,969
8	\$7,103	\$5,210	\$470	\$30,787	\$43,570

## NET ESTIMATED SAVINGS

CIRCUIT NUMBER	GENERATOR SIZE (KW)	TOTAL ANNUAL SAVINGS	TOTAL ANNUAL COSTS	TOTAL NET ANNUAL SAVINGS
3	630	\$33,257	\$41,162	(\$7,905)
5	780	\$42,951	\$56,579	(\$13,627)
6	1720	\$85,171	\$149,923	(\$64,753)
7	1055	\$58,826	\$102,969	(\$44,143)
8	630	\$39,167	\$43,570	(\$4,403)*

Note: \* Selected generator based on larger net annual savings

## COST ESTIMATES FOR NATURAL GAS GENERATORS - SUBSTATION 505 A

	GENERATOR SIZES (KW)			
	630	780	1055	1720
COST OF GENERATOR	\$195,000	\$276,000	\$445,000	\$605,000
TRANSFER SWITCHES	\$63,000	\$78,000	\$105,500	\$172,000
WIRING & CONTROLS	\$6,300	\$7,800	\$10,550	\$17,200
CONCRETE PAD	\$945	\$1,170	\$1,583	\$2,580
GAS LINE (250 ft)	\$2,500	\$2,500	\$2,500	\$2,500
DIGGING, CLEANING, MISC.	\$945	\$1,170	\$1,583	\$2,580
SUB-TOTAL MATERIAL:	\$268,690	\$366,640	\$566,715	\$801,860
TAXES (4.5%):	\$12,091	\$16,499	\$25,502	\$36,084
SUB-TOTAL MATERIAL:	\$280,781	\$383,139	\$592,217	\$837,944
OVERHEAD (10%):	\$28,078	\$38,314	\$59,222	\$83,794
SUB-TOTAL MATERIAL:	\$308,859	\$421,453	\$651,439	\$921,738
PROFIT (10%):	\$30,886	\$42,145	\$65,144	\$92,174
TOTAL MATERIAL:	\$339,745	\$463,598	\$716,583	\$1,013,912
SUB-TOTAL LABOR:	\$7,560	\$9,360	\$12,660	\$20,640
LABOR MARKUP (21%):	\$1,588	\$1,966	\$2,659	\$4,334
SUB-TOTAL LABOR:	\$9,148	\$11,326	\$15,319	\$24,974
OVERHEAD (10%):	\$915	\$1,133	\$1,532	\$2,497
SUB-TOTAL LABOR:	\$10,062	\$12,458	\$16,850	\$27,472
PROFIT (10%):	\$1,006	\$1,246	\$1,685	\$2,747
TOTAL LABOR:	\$11,069	\$13,704	\$18,536	\$30,219
TOTAL MATERIAL & LABOR:	\$350,814	\$477,302	\$735,118	\$1,044,131

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : GAS GENERATOR ON-PK.

06-06-91

Prepared By : E A C

60901891.00

E20-II Advanced Economic Analysis Program

Page 1 of 2

LCCID - based (version 1, level 35).

\*\*\*\*\*  
STUDY IDENTIFICATION BLOCK

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Project Title	:	FORT BELVOIR E.S.O.S
Installation Name	:	SUBSTATION 505-A
Project Number	:	DACA-31-89-C-0198
Fiscal Year	:	1991
Name of Analyst	:	EAC

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KEY STUDY DATES

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ECIP Economic Life	:	25 (years)
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INVESTMENT COST SUMMARY

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Construction cost	\$	350814
SIOH costs	\$	19295
Design costs	\$	21049
Energy credit calc	\$	352042
Salvage value cost	-\$	0
Total investment cost	\$	352042

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ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

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Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	160	973	11.37	11063
DIST	7.43	0	0	17.06	0
RESID	9.97	0	0	16.85	0
NAT G	5.33	-711	-3791	17.52	-66413
COAL	0.00	0	0	13.34	0
TOTAL		-551	-2818		\$ -55350

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NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

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Item	Annual Savings \$	Discount Factor	Discounted Savings
Maintenance	-470	11.65	-5476
Operating	-5210	11.65	-60696
Demand savings	38153	11.65	444482
Total discounted savings(+) / costs(-)			\$ 378310

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## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : GAS GENERATOR ON-PK.

06-06-91

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E20-II Advanced Economic Analysis Program

Page 2 of 2

LCCID - based (version 1, level 35).

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NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
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DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	378310
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Non-energy one-time savings			\$	0
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Total non-energy savings			\$	378310
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PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	-18265
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Non-energy savings-to-investment ratio				-0.21
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(SIR &lt; 1) Project does not qualify.

First year Dollar savings			\$	29655
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Total net discounted savings			\$	322961
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Discounted savings ratio				0.92
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(SIR &lt; 1) Project does not qualify.

Simple payback period (years)				11.87
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## DIESEL GENERATORS FOR PEAK DEMAND REDUCTION - SUBSTATION 505 A

## GENERATING COSTS PER MONTH

CIRCUIT NUMBER	GENERATOR SIZE	GPH	MONTHLY HOURS	KWH	GALLONS	MBTU GEN./MO.	GENERATING COSTS/MO
3	600	31	31	9,018	955	132.4	\$983
5	750	36	40	15,016	1,426	197.7	\$1,468
6	1500	67	97	70,470	6,486	899.6	\$6,680
7	1000	50	86	40,841	4,290	595.0	\$4,419
8	750	36	35	11,743	1,267	175.8	\$1,305

## CAPITAL RECOVERY COSTS

CIRCUIT NUMBER	TOTAL SUMMER HOURS	GENERATOR ESTIMATED LIFE	GENERATOR SIZE	TOTAL COST	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY COSTS/YR
3	123	25	600	\$210,072	0.08776	\$18,436
5	158	25	750	\$262,590	0.08776	\$23,045
6	387	18	1500	\$525,179	0.10122	\$53,159
7	343	20	1000	\$350,120	0.09624	\$33,696
8	141	25	750	\$262,590	0.08776	\$23,045

## TOTAL GENERATOR COSTS

CIRCUIT NUMBER	GENERATING COSTS	OPERATING COSTS	MAINTEN. COSTS	CAPITAL COSTS	TOTAL ANNUAL GENERATOR COSTS
3	\$3,934	\$4,558	\$451	\$18,436	\$27,379
5	\$5,873	\$5,861	\$751	\$23,045	\$35,530
6	\$26,721	\$14,326	\$3,524	\$53,159	\$97,729
7	\$17,675	\$12,698	\$2,042	\$33,696	\$66,111
8	\$5,221	\$5,210	\$587	\$23,045	\$34,062

## NET ESTIMATED SAVINGS

CIRCUIT NUMBER	GENERATOR SIZE (KW)	TOTAL ANNUAL SAVINGS	TOTAL ANNUAL COSTS	TOTAL NET ANNUAL SAVINGS
3	600	\$33,257	\$27,379	\$5,878
5	750	\$42,951	\$35,530	\$7,421 *
6	1500	\$85,171	\$97,729	(\$12,559)
7	1000	\$58,826	\$66,111	(\$7,285)
8	750	\$39,167	\$34,062	\$5,105

Note: \* Selected generator based on larger net annual savings



## COSTS ESTIMATES FOR DIESEL GENERATORS - SUBSTATION 505 A

	GENERATOR SIZES (KW)						
	500	600	750	1000	1100	1250	1500
COST OF GENERATOR	\$75,000	\$90,000	\$112,500	\$150,000	\$165,000	\$187,500	\$225,000
TRANSFER SWITCHES	\$50,000	\$60,000	\$75,000	\$100,000	\$110,000	\$125,000	\$150,000
WIRING & CONTROLS	\$5,000	\$6,000	\$7,500	\$10,000	\$11,000	\$12,500	\$15,000
CONCRETE PAD	\$750	\$900	\$1,125	\$1,500	\$1,650	\$1,875	\$2,250
DIGGING, CLEANING, MISC.	\$750	\$900	\$1,125	\$1,500	\$1,650	\$1,875	\$2,250
SUB-TOTAL MATERIAL:	\$131,500	\$157,800	\$197,250	\$263,000	\$289,300	\$328,750	\$394,500
TAXES (4.5%):	\$5,918	\$7,101	\$8,876	\$11,835	\$13,019	\$14,794	\$17,753
SUB-TOTAL MATERIAL:	\$137,418	\$164,901	\$206,126	\$274,835	\$302,319	\$343,544	\$412,253
OVERHEAD (10%):	\$13,742	\$16,490	\$20,613	\$27,484	\$30,232	\$34,354	\$41,225
SUB-TOTAL MATERIAL:	\$151,159	\$181,391	\$226,739	\$302,319	\$332,550	\$377,898	\$453,478
PROFIT (10%):	\$15,116	\$18,139	\$22,674	\$30,232	\$33,255	\$37,790	\$45,348
TOTAL MATERIAL:	\$166,275	\$199,530	\$249,413	\$332,550	\$365,805	\$415,688	\$498,826
SUB-TOTAL LABOR:	\$6,000	\$7,200	\$9,000	\$12,000	\$13,200	\$15,000	\$18,000
LABOR MARKUP (21%):	\$1,260	\$1,512	\$1,890	\$2,520	\$2,772	\$3,150	\$3,780
SUB-TOTAL LABOR:	\$7,260	\$8,712	\$10,890	\$14,520	\$15,972	\$18,150	\$21,780
OVERHEAD (10%):	\$726	\$871	\$1,089	\$1,452	\$1,597	\$1,815	\$2,178
SUB-TOTAL LABOR:	\$7,986	\$9,583	\$11,979	\$15,972	\$17,569	\$19,965	\$23,958
PROFIT (10%):	\$799	\$958	\$1,198	\$1,597	\$1,757	\$1,997	\$2,396
TOTAL LABOR:	\$8,785	\$10,542	\$13,177	\$17,569	\$19,326	\$21,962	\$26,354
TOTAL MATERIAL & LABOR:	\$175,060	\$210,072	\$262,590	\$350,120	\$385,132	\$437,649	\$525,179

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : DIESEL GEN. ON-PEAK

06-07-91

Prepared By : E A C

60901891.00

E20-II Advanced Economic Analysis Program

Page 1 of 2

LCCID - based (version 1, level 35).

\*\*\*\*\*  
STUDY IDENTIFICATION BLOCK

-----

Project Title	:	FORT BELVOIR E.S.O.S
Installation Name	:	SUBSTATION 505-A
Project Number	:	DACA-31-89-C-0198
Fiscal Year	:	1991
Name of Analyst	:	EAC

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\*\*\*\*\*  
KEY STUDY DATES

-----

ECIP Economic Life	:	25 (years)
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\*\*\*\*\*  
INVESTMENT COST SUMMARY

-----

Construction cost	\$	262590
SIOH costs	\$	14442
Design costs	\$	15755
Energy credit calc	\$	263508
Salvage value cost	-\$	0
Total investment cost	\$	263508

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ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

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Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	205	1244	11.37	14148
DIST	7.43	-791	-5878	17.06	-100277
RESID	9.97	0	0	16.85	0
NAT G	5.33	0	0	17.52	0
COAL	0.00	0	0	13.34	0
TOTAL		-586	-4634		\$ -86128

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NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

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Item	Annual Savings \$	Discount Factor	Discounted Savings
Maintenance	-751	11.65	-8749
Operating	-5861	11.65	-68281
Demand savings	41654	11.65	485269
Total discounted savings(+) / costs(-)			\$ 408239

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## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : DIESEL GEN. ON-PEAK

06-07-91

Prepared By : E A C

60901891.00

E20-II Advanced Economic Analysis Program

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LCCID - based (version 1, level 35).

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NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
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DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	408239
---------------------------	--	--	----	--------

Non-energy one-time savings			\$	0
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Total non-energy savings			\$	408239
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PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	-28422
---------------------	--	--	----	--------

Non-energy savings-to-investment ratio				-0.43
--	--	--	--	-------

(SIR &lt; 1) Project does not qualify.

First year Dollar savings			\$	30408
---------------------------	--	--	----	-------

Total net discounted savings			\$	322111
------------------------------	--	--	----	--------

Discounted savings ratio				1.22
--------------------------	--	--	--	------

Simple payback period (years)				8.67
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## SUBSTATION 505 A

## NATURAL GAS GENERATOR FOR STANDBY GENERATION

## ENERGY GENERATED

SEASON	GENERATOR SIZE (KW)	KW REDUCED	MAXIMUM GEN. HOURS	ESTIMATED GEN. HOURS	MAXIMUM KWH GENERATED	ESTIMATED KWH GENERATED	TOTAL MBTU
Summer	630	345	100	60	34500	20700	70.6
Winter	630	150	100	60	15000	9000	30.7
TOTALS:						29700	101.4

## ENERGY REQUIRED TO GENERATE

SEASON	GENERATOR SIZE (KW)	FULL LOAD CCF/HOUR	PART. LOAD CCF/HOUR	GENERATOR MAX. HOURS	GENERATOR EST. HOURS	NATURAL GAS THERMS	TOTAL MBTU
Summer	630	74	41	100	60	2431	250.7
Winter	630	74	74	100	60	4440	457.8
TOTALS:						6871	708.4

## ANNUAL OPERATION AND MAINTENANCE COSTS

SEASON	ESTIMATED HOURS	EXPECTED LIFE	TOTAL KWH	OPERATING COSTS	MAINTENANCE COSTS	TOTAL O&M COSTS
Summer	60	25	20700	\$2,220	\$207	\$2,427
Winter	60	25	9000	\$2,220	\$90	\$2,310
TOTALS:				\$4,440	\$297	\$4,737

## ELECTRIC SAVINGS WITH MSSG RATE

SEASON	TOTAL KWH	TOTAL KW	TOTAL MBTU	KWH \$ SAVINGS	DEMAND PAYMENTS	TOTAL SAVINGS
Summer	20700	345	70.6	\$429	\$12,420	\$12,849
Winter	9000	150	30.7	\$186	\$5,400	\$5,586
TOTALS:				\$615	\$17,820	\$18,435

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : GAS GEN. STANDBY

06-07-91

Prepared By : E A C

60901891.00

E20-II Advanced Economic Analysis Program

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## STUDY IDENTIFICATION BLOCK

Project Title : FORT BELVOIR E.S.O.S  
 Installation Name : SUBSTATION 505-A  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 25 (years)

## INVESTMENT COST SUMMARY

Construction cost \$ 350814  
 SIOH costs \$ 19295  
 Design costs \$ 21049  
 Energy credit calc \$ 352042  
 Salvage value cost -\$ 0  
 Total investment cost \$ 352042

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	101	615	11.37	6998
DIST	7.43	0	0	17.06	0
RESID	9.97	0	0	16.85	0
NAT G	5.33	-708	-3776	17.52	-66152
COAL	0.00	0	0	13.34	0
TOTAL		-607	-3160		\$ -59153

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Maintenance	-297	11.65	-3460
Operating	-4440	11.65	-51726
Demand credits	17820	11.65	207603
Total discounted savings(+) / costs(-)			\$ 152417

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : GAS GEN. STANDBY

06-07-91

Prepared By : E A C

60901891.00

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NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	---------------------	------	-----------------	--------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

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DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	152417
---------------------------	--	--	----	--------

Non-energy one-time savings			\$	0
-----------------------------	--	--	----	---

Total non-energy savings			\$	152417
--------------------------	--	--	----	--------

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PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	-19521
---------------------	--	--	----	--------

Non-energy savings-to-investment ratio				-0.22
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(SIR &lt; 1) Project does not qualify.

First year Dollar savings			\$	9923
---------------------------	--	--	----	------

Total net discounted savings			\$	93264
------------------------------	--	--	----	-------

Discounted savings ratio				0.26
--------------------------	--	--	--	------

(SIR &lt; 1) Project does not qualify.

Simple payback period (years)				35.48
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## SUBSTATION 505 A

## DIESEL GENERATOR FOR STANDBY GENERATION

## ENERGY GENERATED

SEASON	GENERATOR SIZE (KW)	KW REDUCED	MAXIMUM HOURS	MAXIMUM KWH GENERATED	ESTIMATED KWH GENERATED	TOTAL MBTU
Summer	750	345	100	34500	20700	70.6
Winter	750	150	100	15000	9000	30.7
TOTALS:					29700	101.4

## ENERGY REQUIRED TO GENERATE

SEASON	GENERATOR SIZE (KW)	FUEL GPH	GENERATOR MAX. HOURS	GENERATOR EST. HOURS	DIESEL GALLONS	TOTAL MBTU
Summer	750	30	100	60	1800	249.7
Winter	750	16	100	60	960	133.2
TOTALS:					2760	382.8

## ANNUAL OPERATION AND MAINTENANCE COSTS

SEASON	ESTIMATED HOURS	EXPECTED LIFE	TOTAL KWH	OPERATING COSTS	MAINTENANCE COSTS	TOTAL O & M COSTS
Summer	60	25	20700	\$2,220	\$259	\$2,479
Winter	60	25	9000	\$2,220	\$113	\$2,333
TOTALS:				\$4,440	\$371	\$4,811

## ELECTRIC SAVINGS WITH MSSG RATE

SEASON	TOTAL KWH	TOTAL KW	TOTAL MBTU	KWH \$ SAVINGS	DEMAND PAYMENTS	TOTAL SAVINGS
Summer	20700	345	70.6	\$429	\$12,420	\$12,849
Winter	9000	150	30.7	\$186	\$5,400	\$5,586
TOTALS:				\$615	\$17,820	\$18,435

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : DIESEL GEN. STANDBY

06-07-91

Prepared By : E A C

60901891.00

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 STUDY IDENTIFICATION BLOCK

-----  
 Project Title : FORT BELVOIR E.S.O.S  
 Installation Name : SUBSTATION 505-A  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC  
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 KEY STUDY DATES

-----  
 ECIP Economic Life : 25 (years)  
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 INVESTMENT COST SUMMARY

-----  
 Construction cost \$ 262590  
 SIOH costs \$ 14442  
 Design costs \$ 15755  
 Energy credit calc \$ 263508  
 Salvage value cost -\$ 0  
 Total investment cost \$ 263508  
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 ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	101	615	11.37	6998
DIST	7.43	-383	-2844	17.06	-48522
RESID	9.97	0	0	16.85	0
NAT G	5.33	0	0	17.52	0
COAL	0.00	0	0	13.34	0
TOTAL		-281	-2229		\$ -41524

\*\*\*\*\*  
 NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Maintenance	-615	11.65	-7165
Operating	-4440	11.65	-51726
Demand credits	17820	11.65	207603
Total discounted savings(+) / costs(-)			\$ 148712

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## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : DIESEL GEN. STANDBY

06-07-91

Prepared By : E A C

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NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
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DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	148712
---------------------------	--	--	----	--------

Non-energy one-time savings			\$	0
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Total non-energy savings			\$	148712
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PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	-13703
---------------------	--	--	----	--------

Non-energy savings-to-investment ratio				-0.21
--	--	--	--	-------

(SIR &lt; 1) Project does not qualify.

First year Dollar savings			\$	10536
---------------------------	--	--	----	-------

Total net discounted savings			\$	107188
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Discounted savings ratio				0.41
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(SIR &lt; 1) Project does not qualify.

Simple payback period (years)				25.01
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BUILDING 1359

BUILDING 1359

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ECO #5	1359-113
ECO #6	1359-120
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## DESIGN PARAMETERS, SHGs

Location : FT. BELVOIR, VIRGINIA

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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## DESIGN WEATHER PARAMETERS

City Name.....: FT. BELVOIR  
 Location.....: VIRGINIA  
 Latitude.....: 38.4 deg  
 Elevation.....: 69.0 ft  
 Summer Design Dry Bulb Temp.....: 90.0 F  
 Summer Design Wet Bulb Temp.....: 75.0 F  
 Daily Temperature Range.....: 23.0 F  
 Winter Design Dry Bulb Temp.....: 12.0 F  
 Atmospheric Clearness Number.....: 1.00

TABLE 1. MAXIMUM SOLAR HEAT GAINS - AVERAGE DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	24.2	61.1	97.3	110.1	97.3	61.1	24.2	24.2	80.0
Feb	31.8	74.8	105.7	113.8	105.7	74.8	31.8	31.8	107.2
Mar	40.8	87.0	106.9	108.0	106.9	87.0	40.8	40.8	136.8
Apr	60.0	97.4	104.4	97.2	104.4	97.4	60.0	49.3	164.3
May	74.9	103.0	98.4	84.0	98.4	103.0	74.9	54.9	181.8
Jun	85.1	109.3	97.5	79.2	97.5	109.3	85.1	57.9	195.2
Jul	80.6	106.7	98.1	81.4	98.1	106.7	80.6	56.4	189.3
Aug	69.1	104.1	105.7	94.4	105.7	104.1	69.1	52.2	177.6
Sep	52.3	99.3	114.8	111.6	114.8	99.3	52.3	45.4	158.1
Oct	36.4	88.3	117.7	122.9	117.7	88.3	36.4	36.4	128.2
Nov	26.7	66.5	101.8	113.3	101.8	66.5	26.7	26.7	89.4
Dec	21.4	53.0	87.6	100.9	87.6	53.0	21.4	21.4	68.4

TABLE 2. MAXIMUM SOLAR HEAT GAINS - DESIGN DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	20.4	158.9	243.9	253.8	243.9	158.9	20.4	20.4	142.0
Feb	53.0	189.1	246.5	237.5	246.5	189.1	53.0	24.7	187.7
Mar	95.9	219.8	234.5	200.7	234.5	219.8	95.9	29.4	229.0
Apr	141.6	224.4	200.1	146.7	200.1	224.4	141.6	34.1	256.0
May	166.1	220.1	170.7	104.6	170.7	220.1	166.1	37.4	268.0
Jun	173.2	215.4	156.7	87.8	156.7	215.4	173.2	47.4	269.7
Jul	163.7	215.7	166.5	101.4	166.5	215.7	163.7	38.3	264.7
Aug	136.4	216.6	193.1	141.7	193.1	216.6	136.4	35.8	251.3
Sep	90.3	207.2	224.7	194.9	224.7	207.2	90.3	30.6	221.4
Oct	52.0	182.7	238.2	230.6	238.2	182.7	52.0	25.5	184.4
Nov	20.7	156.1	239.8	249.9	239.8	156.1	20.7	20.7	141.3
Dec	18.5	141.9	236.4	254.2	236.4	141.9	18.5	18.5	122.2

1359-1A

# MASTER SCHEDULE SUMMARY

Prepared By : E A C  
 Barrier Hourly Analysis Program

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 04-27-91  
 6100190202

## \*\*\*\*\* MASTER SCHEDULE 1. OCCUPANCY (GENERAL) Hourly Percentages \*\*\*\*\*

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	0	0	0	0	0	0	80	100	100	100	100	100
Saturday	0	0	0	0	0	0	0	5	25	30	30	30
Sunday	0	0	0	0	0	0	0	5	25	30	30	30
DESIGN	0	0	0	0	0	10	80	100	100	100	100	100
Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	80	50	50	10	5	5	0	0
Saturday	30	30	30	30	25	5	0	0	0	0	0	0
Sunday	30	30	30	30	25	5	0	0	0	0	0	0
DESIGN	100	100	100	100	100	100	100	20	10	0	0	0

## \*\*\*\*\* MASTER SCHEDULE 2. LIGHTING Hourly Percentages \*\*\*\*\*

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	5	5	5	5	5	10	80	90	100	100	100	100
Saturday	5	5	5	5	5	5	5	20	80	80	80	90
Sunday	5	5	5	5	5	5	5	20	80	80	80	90
DESIGN	10	10	10	10	10	20	50	100	100	100	100	100
Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	90	70	70	70	70	70	70	10
Saturday	90	90	90	90	50	40	5	5	5	5	5	5
Sunday	90	90	90	90	50	40	5	5	5	5	5	5
DESIGN	100	100	100	100	100	100	100	50	20	10	10	10

## \*\*\*\*\* MASTER SCHEDULE 3. EQUIPMENT Hourly Percentages \*\*\*\*\*

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	5	5	5	5	5	5	20	50	100	100	100	100
Saturday	5	5	5	5	5	5	10	10	15	20	20	20
Sunday	5	5	5	5	5	5	5	10	10	10	10	20
DESIGN	10	10	10	10	10	20	40	100	100	100	100	100
Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	80	50	20	10	5	5	5	5
Saturday	20	20	20	10	10	10	10	10	5	5	5	5
Sunday	20	15	15	10	10	10	10	5	5	5	5	5
DESIGN	100	100	100	100	100	100	100	40	20	10	10	10

MASTER SCHEDULE SUMMARY

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Prepared By : E A C

04-27-91

Carrier Hourly Analysis Program

6100190202

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MASTER SCHEDULE 4. DOMESTIC HOT WATER Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	0	0	0	0	0	5	10	10	20	20	20	80
Saturday	0	0	0	0	0	2	2	2	5	5	5	5
Sunday	0	0	0	0	0	0	0	2	2	2	2	2
DESIGN	0	0	0	0	0	5	5	20	20	20	20	80

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	80	20	20	20	10	10	5	5	5	2	0	0
Saturday	5	5	5	2	2	2	2	2	0	0	0	0
Sunday	2	2	2	2	2	2	0	0	0	0	0	0
DESIGN	80	20	20	20	10	10	5	5	2	2	0	0

\*\*\*\*\*

MASTER SCHEDULE 5. OCCUPANCY (TOWER) Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	0	0	0	0	0	0	100	100	100	100	100	100
Saturday	0	0	0	0	0	0	0	33	100	100	100	100
Sunday	0	0	0	0	0	0	0	33	100	100	100	100
DESIGN	0	0	0	0	0	10	100	100	100	100	100	100

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	100	100	100	100	100	100	100	33
Saturday	100	100	100	100	66	0	0	0	0	0	0	0
Sunday	100	100	100	100	66	0	0	0	0	0	0	0
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*

MASTER SCHEDULE 6. EQUIPMENT (CONSTANT) Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	10	10	10	10	10	10	80	100	100	100	100	100
Saturday	10	10	10	10	10	10	10	10	80	100	100	100
Sunday	10	10	10	10	10	10	10	10	80	100	100	100
DESIGN	10	10	10	10	10	20	80	100	100	100	100	100

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	80	80	80	80	80	80	80	10
Saturday	100	100	100	100	80	80	50	10	10	10	10	10
Sunday	100	100	100	100	80	80	50	10	10	10	10	10
DESIGN	100	100	100	100	100	100	100	100	100	100	100	10

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## MASTER SCHEDULE SUMMARY

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Prepared By : E A C

04-27-91

Carrier Hourly Analysis Program

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## MASTER SCHEDULE 7. PIPE &amp; EQ. RADIATION Hourly Percentages

Hour ----->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

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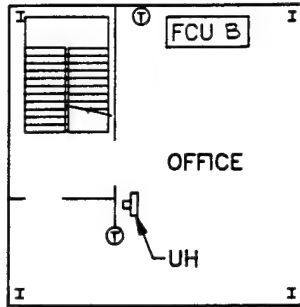
## MASTER SCHEDULE 8. OCCUPANCY (RADAR RM.) Hourly Percentages

Hour ----->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	0	0	0	0	0	0	0	33	100	100	100	100
Saturday	0	0	0	0	0	0	0	33	66	66	66	66
Sunday	0	0	0	0	0	0	0	0	0	0	0	0
DESIGN	0	0	0	0	0	33	100	100	100	100	100	100

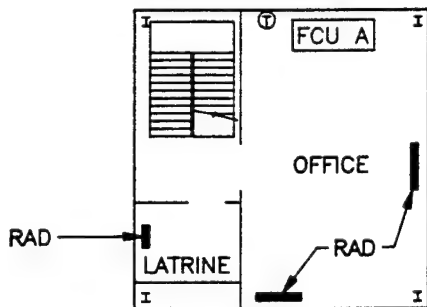
  

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	66	100	100	100	100	66	33	0	0	0	0	0
Saturday	33	66	66	66	66	33	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0
DESIGN	100	100	100	100	100	100	100	100	100	100	100	33

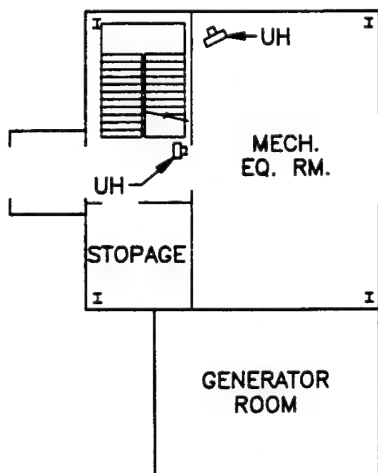
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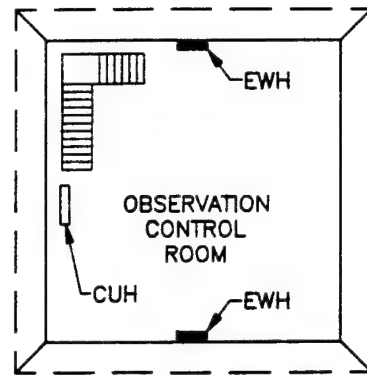
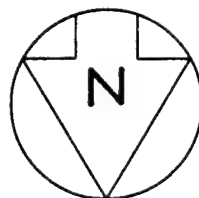
THIRD FLOOR PLAN



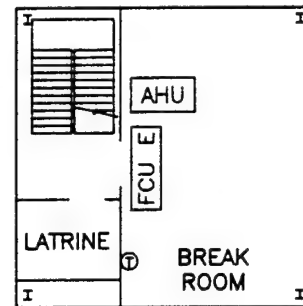
SECOND FLOOR PLAN



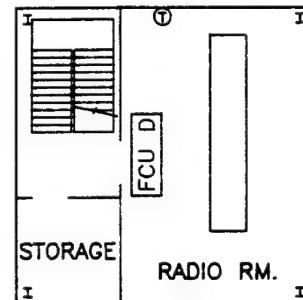
GROUND FLOOR PLAN



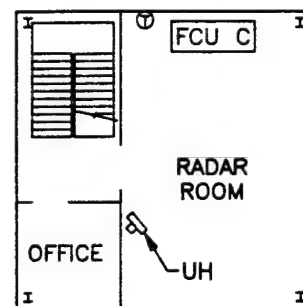
SEVENTH FLOOR PLAN



SIXTH FLOOR PLAN



FIFTH FLOOR PLAN



FOURTH FLOOR PLAN

BUILDING 1359 KEY PLAN



ENGINEERING ANALYSIS

Sheet 1 of 1

By: REF

Calculations for Infiltration

Building

Project: ESOS, Fort BELVOIR, BLDG 1359 Date: DEC. 1990

Contract No: DACA-31-89-C-0189 EAC Project No.: 89034.0

Calculations based on ASHRAE 1989 Page F 2.3.14.

Building Leakage Area

	Effective Leakage Area, in <sup>2</sup>	Building Component Parameter	Building Leakage Area D <sub>L</sub> , in <sup>2</sup>
	$L$	$D_L$	$L$
SKIN CRACK	.5/LF	80 FT	40.00
Sill foundation	0.19/ft. of perimeter	84 ft.	15.96
Joints, ceiling/wall	0.12/ft. of wall	84 ft.	10.10
Windows	0.063/ft <sup>2</sup> . of window	135 ft <sup>2</sup> .	8.50
Doors	0.215/ft <sup>2</sup> . of doors	78 ft <sup>2</sup> .	16.77
Wall - Window frames	0.15/ft <sup>2</sup> . of window	135 ft <sup>2</sup> .	20.25
- Door frames	0.072/ft <sup>2</sup> . of door	78 ft <sup>2</sup> .	5.62
Elec. outlet/switch	0.16/fixture	20 ft <sup>2</sup> .EA.	3.20
Recessed lights	1.6/fixture	6 ft <sup>2</sup> .EA.	9.60
Pipe penetration	1.55/in <sup>2</sup> . of pipe	4 ft <sup>2</sup> .EA.	6.20
Exhaust fans	6.0/fan	2 ft <sup>2</sup> .EA.	12.00
Duct penetration	2.2/SF	16.5 SF	36.30
FCU openings	60 x 1/3(SF/unit) x 2.2/SF		<u>1</u>
			185 in <sup>2</sup> .

Infiltration  $Q(\text{cfm}) = L \times (A \Delta t + Bv)^{1/2}$

(ASHRAE 1989, P. 23.17, EQ.33)

Winter

Summer

$Q(\text{cfm}) =$   
 $= L(0.01313 \times 51 + 0.0157 \times 14^2)^{1/2}$   
 $= L \times 2.2$   
 $= 185 \times 2.2 = 407 \text{ CFM}$

$\text{Rate} = \frac{407}{2940}$   
 $= 0.139 \text{ CFM/SF}$

$= L(0.0313 \times 15 + 0.0157 \times 10^2)^{1/2}$   
 $= L \times 1.45$   
 $= 185 \times 1.45 = 270 \text{ CFM}$

$\text{Rate} = \frac{270}{2940}$   
 $= 0.092 \text{ CFM/SF}$

# COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - EQUIP. RM.

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = GROUND FL. - EQUIP. RM.

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2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	138.0	0.0	33.7
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

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3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->						
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - EQUIP. RM.

04-27-91

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## 4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	8.3	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	275 sqft	Building Wt. =	M	lb/sqft
PEOPLE	:	sqft/person	=	0.0	Total People =		0
	:	Schedule No.	=	1	Activity Level =		2
LIGHTING	:	W/sqft	=	1.31	Total Watts =		360
	:	Schedule No.	=	2	Wattage Mult. =		1.00
	:	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	4.00	Total Watts =			1,100
	Schedule No.	=	6				
MISC. SENSIBLE:	Load	=	6,700 BTU/hr	Schedule No. =			4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =			1

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## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	130.0	0.400	0.0 F	0.0 F
Ceilings	70.0	0.420	0.0 F	30.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	41 CFM	Area	: 275.0 sqft
Heating	: 0.28 CFM/sqft =	77 CFM	Perimeter	: 34.0 ft
Typical	: 0.28 CFM/sqft =	77 CFM	Depth	: 0.0 ft

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COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - STORAGE RM.

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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1. SPACE NAME = GROUND FL. - STORAGE RM.

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2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	70.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	70.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - STORAGE RM.

04-27-91

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## 4. GLASS INFORMATION (continued)

Exposure	Glass Areas (sqft)					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA : Floor Area = 50 sqft Building Wt. = M lb/sqft

PEOPLE : sqft/person = 0.0 Total People = 0  
Schedule No. = 1 Activity Level = 2

LIGHTING : W/sqft = 1.20 Total Watts = 60  
Schedule No. = 2 Wattage Mult. = 1.00  
Fixture Type = 3 Free-hanging

OTHER ELECTRIC: W/sqft = 0.00 Total Watts = 0  
Schedule No. = 3

MISC. SENSIBLE: Load = 0 BTU/hr Schedule No. = 4  
MISC. LATENT : Load = 0 BTU/hr Schedule No. = 1

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## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)	Unconditioned Space Temp.			
	Area	U-Value	Cooling	Heating
	(sqft)	(BTU/hr/sqft/F)	(deg F or %)	(deg F or %)
Walls	0.0	0.400	110.0 %	10.0 F
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	0.0	0.100	90.0 F	50.0 F

INFILTRATION		GROUND ELEMENT	
Cooling	: 0.14 CFM/sqft = 7 CFM	Area	: 50.0 sqft
Heating	: 0.10 CFM/sqft = 5 CFM	Perimeter	: 14.0 ft
Typical	: 0.14 CFM/sqft = 7 CFM	Depth	: 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - STAIR

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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1. SPACE NAME = GROUND FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	96.0	0.0	21.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : GROUND FL. - STAIR

04-27-91

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## 4. GLASS INFORMATION (continued)

Exposure	Glass Areas (sqft)					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	95 sqft	Building Wt.	=	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	2
LIGHTING	: W/sqft	=	1.26	Total Watts	=	120
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts	=	0
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

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## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	70.0	0.420	10.0 F	10.0 F
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	14 CFM	Area	: 95.0 sqft
Heating	: 0.28 CFM/sqft =	27 CFM	Perimeter	: 28.0 ft
Typical	: 0.28 CFM/sqft =	27 CFM	Depth	: 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - OFFICE

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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1. SPACE NAME = 2ND FL. - OFFICE

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2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	138.0	0.0	0.0
W	0.0	0.0	0.0
NW	130.0	0.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - OFFICE

04-27-91

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## 4. GLASS INFORMATION (continued)

Exposure	Glass Areas (sqft)					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	12.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	275 sqft	Building Wt. =	M lb/sqft
PEOPLE	: sqft/person	=	137.5	Total People =	2
	Schedule No.	=	1	Activity Level =	2
LIGHTING	: W/sqft	=	1.19	Total Watts =	326
	Schedule No.	=	2	Wattage Mult. =	1.00
	Fixture Type	=	3 Free-hanging		
OTHER ELECTRIC:	W/sqft	=	1.20	Total Watts =	330
	Schedule No.	=	3		
MISC. SENSIBLE:	Load	=	3,000 BTU/hr	Schedule No. =	7
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =	1

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## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	130.0	0.400	90.0 %	30.0 F
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	275.0	0.270	90.0 %	30.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	41 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	55 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	55 CFM	Depth	: 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - LATRINE

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = 2ND FL. - LATRINE

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2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	64.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	70.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - LATRINE

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

Exposure	<----- Glass Areas (sqft) ----->					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	6.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

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## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	50 sqft	Building Wt. =	M	lb/sqft
PEOPLE	:	sqft/person	=	0.0	Total People	=	0
	:	Schedule No.	=	1	Activity Level	=	2
LIGHTING	:	W/sqft	=	1.20	Total Watts	=	60
	:	Schedule No.	=	2	Wattage Mult.	=	1.00
	:	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	:	W/sqft	=	0.00	Total Watts	=	0
	:	Schedule No.	=	3			
MISC. SENSIBLE:	:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	:	Load	=	0 BTU/hr	Schedule No.	=	1

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## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.400	110.0 %	10.0 F
Ceilings	0.0	0.270	15.0 F	10.0 F
Floors	50.0	0.270	0.0 F	40.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	:	0.15 CFM/sqft =	8 CFM	Area : 0.0 sqft
Heating	:	0.20 CFM/sqft =	10 CFM	Perimeter : 0.0 ft
Typical	:	0.20 CFM/sqft =	10 CFM	Depth : 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - STAIR

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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1. SPACE NAME = 2ND FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	118.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 2ND FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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4. GLASS INFORMATION (continued)

----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	12.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	95 sqft	Building Wt.	=	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	2
LIGHTING	: W/sqft	=	1.26	Total Watts	=	120
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts	=	0
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.400	0.0 %	0.0 %
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	0.0	0.100	90.0 F	50.0 F

INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	14 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	19 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	19 CFM	Depth	: 0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 3RD FL. - OFFICE

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 2

1. SPACE NAME = 3RD FL. - OFFICE

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	70.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	188.0	0.0
W	0.0	0.0	0.0
NW	0.0	200.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 3RD FL. - OFFICE

04-27-91

Prepared By : E A C

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Barrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	12.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	275 sqft	Building Wt. =	M lb/sqft
PEOPLE	:	sqft/person	=	68.8	Total People =	4
	:	Schedule No.	=	1	Activity Level =	2
LIGHTING	:	W/sqft	=	1.28	Total Watts =	352
	:	Schedule No.	=	2	Wattage Mult. =	1.20
	:	Fixture Type	=	3 Free-hanging		
OTHER ELECTRIC:	W/sqft	=	3.02	Total Watts =	830	
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	2,000 BTU/hr	Schedule No. =	7	
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =	1	

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	130.0	0.400	90.0 %	30.0 F
Ceilings	0.0	0.420	90.0 %	10.0 F
Floors	0.0	0.570	90.0 %	10.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	41 CFM	Area :	0.0 sqft
Heating	: 0.20 CFM/sqft =	55 CFM	Perimeter :	0.0 ft
Typical	: 0.20 CFM/sqft =	55 CFM	Depth :	0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 3RD FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = 3RD FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	118.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0



# COMPLEX SPACE DESCRIPTION

Space Name : 3RD FL. - STAIR

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	12.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	95 sqft	Building Wt. =	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People =	0
	Schedule No.	=	1	Activity Level =	2
LIGHTING	: W/sqft	=	1.26	Total Watts =	120
	Schedule No.	=	2	Wattage Mult. =	1.00
	Fixture Type	=	3 Free-hanging		
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts =	0
	Schedule No.	=	3		
MISC. SENSIBLE: Load		=	0 BTU/hr	Schedule No. =	4
MISC. LATENT : Load		=	0 BTU/hr	Schedule No. =	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	70.0	0.400	0.0 %	30.0 F
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION			GROUND ELEMENT	
Cooling : 0.15 CFM/sqft =	14 CFM	Area :	0.0 sqft	
Heating : 0.20 CFM/sqft =	19 CFM	Perimeter :	0.0 ft	
Typical : 0.20 CFM/sqft =	19 CFM	Depth :	0.0 ft	

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - RADAR RM.

04-27-91

Prepared By : E A C

6100190202

Barrier Hourly Analysis Program

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1. SPACE NAME = 4TH FL. - RADAR RM.

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.560

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	130.0	0.0
S	0.0	0.0	0.0
SW	0.0	188.0	9.0
W	0.0	0.0	0.0
NW	0.0	130.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->						
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0

COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - RADAR RM.

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	3.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	275 sqft	Building Wt. =	M	lb/sqft
PEOPLE	: sqft/person	=	91.7	Total People =		3
	Schedule No.	=	8	Activity Level =		3
LIGHTING	: W/sqft	=	1.10	Total Watts =		303
	Schedule No.	=	2	Wattage Mult. =		1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	12.00	Total Watts =		3,300
	Schedule No.	=	6			
MISC. SENSIBLE:	Load	=	1,000 BTU/hr	Schedule No. =		7
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =		1

\*\*\*\*\*

6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	70.0	0.420	90.0 %	30.0 F
Ceilings	0.0	0.420	90.0 %	10.0 F
Floors	0.0	0.570	90.0 %	10.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	41 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	55 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	55 CFM	Depth	: 0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - PC RM.

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = 4TH FL. - PC RM.

\*\*\*\*\*

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	70.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	70.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - PC RM.

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

Exposure	<----- Glass Areas (sqft) ----->					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	50 sqft	Building Wt.	=	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	2
LIGHTING	: W/sqft	=	1.20	Total Watts	=	60
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts	=	0
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.400	110.0 %	10.0 F
Ceilings	50.0	0.270	90.0 F	30.0 F
Floors	0.0	0.270	90.0 %	40.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	8 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	10 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	10 CFM	Depth	: 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = 4TH FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	118.0	0.0
E	0.0	0.0	0.0
SE	0.0	70.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 4TH FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

Exposure	<----- Glass Areas (sqft) ----->					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	12.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	95 sqft	Building Wt. =	M	lb/sqft
PEOPLE	:	sqft/person	=	0.0	Total People =		0
	:	Schedule No.	=	1	Activity Level =		2
LIGHTING	:	W/sqft	=	1.26	Total Watts =		120
	:	Schedule No.	=	2	Wattage Mult. =		1.00
	:	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts =			0
	Schedule No.	=	3				
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No. =			4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =			1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)	Unconditioned Space Temp.			
	Area	U-Value	Cooling	Heating
	(sqft)	(BTU/hr/sqft/F)	(deg F or %)	(deg F or %)
Walls	0.0	0.400	0.0 %	30.0 F
Ceilings	0.0	0.420	15.0 F	10.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION	GROUND ELEMENT			
Cooling	: 0.15 CFM/sqft =	14 CFM	Area :	0.0 sqft
Heating	: 0.20 CFM/sqft =	19 CFM	Perimeter :	0.0 ft
Typical	: 0.20 CFM/sqft =	19 CFM	Depth :	0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - RADIO EQ. RM.

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 2

1. SPACE NAME = 5TH FL. - RADIO EQ. RM.

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.560

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	130.0	0.0
S	0.0	0.0	0.0
SW	0.0	188.0	0.0
W	0.0	0.0	0.0
NW	0.0	130.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0



# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - RADIO EQ. RM.

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	12.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	275 sqft	Building Wt.	=	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	3
LIGHTING	: W/sqft	=	0.87	Total Watts	=	240
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	10.00	Total Watts	=	2,750
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	70.0	0.420	90.0 %	30.0 F
Ceilings	0.0	0.420	90.0 %	10.0 F
Floors	0.0	0.420	90.0 %	30.0 F
INFILTRATION		GROUND ELEMENT		
Cooling	: 0.15 CFM/sqft =	41 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	55 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	55 CFM	Depth	: 0.0 ft

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# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - STORAGE

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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1. SPACE NAME = 5TH FL. - STORAGE

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2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

Exposure	<----- Net Wall Areas (sqft) ----->		
	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	70.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	70.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

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# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - STORAGE

04-27-91

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Carrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	50 sqft	Building Wt. =	M lb/sqft
PEOPLE	:	sqft/person	=	0.0	Total People =	0
	:	Schedule No.	=	1	Activity Level =	2
LIGHTING	:	W/sqft	=	1.20	Total Watts =	60
	:	Schedule No.	=	2	Wattage Mult. =	1.00
	:	Fixture Type	=	3 Free-hanging		
OTHER ELECTRIC:	:	W/sqft	=	0.00	Total Watts =	0
	:	Schedule No.	=	3		
MISC. SENSIBLE:	:	Load	=	0 BTU/hr	Schedule No. =	4
MISC. LATENT	:	Load	=	0 BTU/hr	Schedule No. =	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.400	110.0 %	10.0 F
Ceilings	0.0	0.270	90.0 F	30.0 F
Floors	0.0	0.270	90.0 %	40.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	:	0.15 CFM/sqft =	8 CFM	Area : 0.0 sqft
Heating	:	0.20 CFM/sqft =	10 CFM	Perimeter : 0.0 ft
Typical	:	0.20 CFM/sqft =	10 CFM	Depth : 0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 2

1. SPACE NAME = 5TH FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	118.0	0.0
E	0.0	0.0	0.0
SE	0.0	70.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 5TH FL. - STAIR

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Prepared By : E A C

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Barrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

Exposure	Glass Areas (sqft)					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	12.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	95 sqft	Building Wt. =	M lb/sqft
PEOPLE	:	sqft/person	=	0.0	Total People =	0
	:	Schedule No.	=	1	Activity Level =	2
LIGHTING	:	W/sqft	=	1.26	Total Watts =	120
	:	Schedule No.	=	2	Wattage Mult. =	1.00
	:	Fixture Type	=	3 Free-hanging		
OTHER ELECTRIC:	:	W/sqft	=	0.00	Total Watts =	0
	:	Schedule No.	=	3		
MISC. SENSIBLE:	:	Load	=	0 BTU/hr	Schedule No. =	4
MISC. LATENT	:	Load	=	0 BTU/hr	Schedule No. =	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.420	0.0 F	30.0 F
Ceilings	0.0	0.570	0.0 F	30.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	:	0.15 CFM/sqft =	14 CFM	Area : 0.0 sqft
Heating	:	0.20 CFM/sqft =	19 CFM	Perimeter : 0.0 ft
Typical	:	0.20 CFM/sqft =	19 CFM	Depth : 0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - CONFERENCE RM.

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 2

1. SPACE NAME = 6TH FL. - CONFERENCE RM.

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.560

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	0.0	0.0
E	0.0	0.0	0.0
SE	0.0	130.0	0.0
S	0.0	0.0	0.0
SW	0.0	173.0	15.0
W	0.0	0.0	0.0
NW	0.0	130.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->						
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - CONFERENCE RM.

04-27-91

Prepared By : E A C

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Barrier Hourly Analysis Program

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## 4. GLASS INFORMATION (continued)

<----- Glass Areas (sqft) ----->						
Exposure	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	12.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	:	Floor Area	=	275 sqft	Building Wt. =	M	lb/sqft
PEOPLE	:	sqft/person	=	45.8	Total People =		6
	:	Schedule No.	=	1	Activity Level =		2
LIGHTING	:	W/sqft	=	2.91	Total Watts =		800
	:	Schedule No.	=	2	Wattage Mult. =		1.20
	:	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	1.82	Total Watts =			500
	Schedule No.	=	6				
MISC. SENSIBLE:	Load	=	1,000 BTU/hr	Schedule No. =			7
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =			1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	70.0	0.420	90.0 %	30.0 F
Ceilings	0.0	0.420	90.0 %	10.0 F
Floors	0.0	0.570	90.0 %	10.0 F
INFILTRATION		GROUND ELEMENT		
Cooling	: 0.15 CFM/sqft =	41 CFM	Area :	0.0 sqft
Heating	: 0.20 CFM/sqft =	55 CFM	Perimeter :	0.0 ft
Typical	: 0.20 CFM/sqft =	55 CFM	Depth :	0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - LATRINE

04-27-91

Prepared By : E A C

6100190202

Barrier Hourly Analysis Program

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1. SPACE NAME = 6TH FL. - LATRINE

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	64.0	0.0
E	0.0	0.0	0.0
SE	0.0	0.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	70.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->							
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)	
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0	0.0



# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - LATRINE  
 Prepared By : E A C  
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## 4. GLASS INFORMATION (continued)

Exposure	<----- Glass Areas (sqft) ----->					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	6.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	50 sqft	Building Wt. =	M	lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	2
LIGHTING	: W/sqft	=	2.00	Total Watts	=	100
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts	=	0
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.400	90.0 F	10.0 F
Ceilings	0.0	0.270	90.0 F	30.0 F
Floors	0.0	0.270	90.0 %	40.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	8 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	10 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	10 CFM	Depth	: 0.0 ft

# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - STAIR

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 2

1. SPACE NAME = 6TH FL. - STAIR

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.570

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	115.0	15.0
E	0.0	0.0	0.0
SE	0.0	70.0	0.0
S	0.0	0.0	0.0
SW	0.0	0.0	0.0
W	0.0	0.0	0.0
NW	0.0	0.0	0.0
N	0.0	0.0	0.0

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	0.0

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->						
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)
Shade 1	8.0	4.0	0.0	0.0	0.0	0.0
Shade 2	8.0	4.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0

# COMPLEX SPACE DESCRIPTION

Space Name : 6TH FL. - STAIR

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Prepared By : E A C

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## 4. GLASS INFORMATION (continued)

Exposure	<----- Glass Areas (sqft) ----->					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	0.0	0	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	0	0.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	0	0.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	0	0.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	95 sqft	Building Wt.	=	M lb/sqft
PEOPLE	: sqft/person	=	0.0	Total People	=	0
	Schedule No.	=	1	Activity Level	=	2
LIGHTING	: W/sqft	=	0.63	Total Watts	=	60
	Schedule No.	=	2	Wattage Mult.	=	1.00
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	0.00	Total Watts	=	0
	Schedule No.	=	3			
MISC. SENSIBLE:	Load	=	0 BTU/hr	Schedule No.	=	4
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No.	=	1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.420	0.0 F	30.0 F
Ceilings	0.0	0.570	0.0 F	30.0 F
Floors	0.0	0.100	90.0 F	50.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	14 CFM	Area	: 0.0 sqft
Heating	: 0.20 CFM/sqft =	19 CFM	Perimeter	: 0.0 ft
Typical	: 0.20 CFM/sqft =	19 CFM	Depth	: 0.0 ft

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 7TH FL. - OBSERVATION

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

1. SPACE NAME = 7TH FL. - OBSERVATION

\*\*\*\*\*

2. WALL INFORMATION (Number of Wall Types = 3)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)
Wall Type 1	51	M	0.400
Wall Type 2	L	D	0.170
Wall Type 3	L	D	0.560

<----- Net Wall Areas (sqft) ----->			
Exposure	Wall Type 1	Wall Type 2	Wall Type 3
NE	0.0	100.0	0.0
E	0.0	0.0	0.0
SE	0.0	100.0	0.0
S	0.0	0.0	0.0
SW	0.0	100.0	15.0
W	0.0	0.0	0.0
NW	0.0	100.0	0.0
N	0.0	0.0	0.0

\*\*\*\*\*

3. ROOF INFORMATION (Number of Roof Types = 1)

	Weight (lb/sqft)	Ext Color (D,M,L)	U-Value (BTU/hr/sqft/F)	Area (sqft)
Roof 1	M	M	0.220	676.0

\*\*\*\*\*

4. GLASS INFORMATION (Number of Glass Types = 2)

	U-Value (BTU/hr/sqft/F)	Glass Factor	Internal Shades
Glass Type 1	1.100	1.00	N
Glass Type 2	0.580	0.90	N

<----- External Shading Information ----->						
Window Height (ft)	Window Width (ft)	Reveal Depth (in)	Overhang Height (in)	Overhang Extension (in)	Fin Separation (in)	Fin Exten. (in)
Shade 1	6.0	20.0	0.0	0.0	2.0	0.0
Shade 2	6.0	4.0	0.0	0.0	0.0	0.0
Shade 3	8.0	4.0	0.0	0.0	0.0	0.0

\*\*\*\*\*

# COMPLEX SPACE DESCRIPTION

Space Name : 7TH FL. - OBSERVATION

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Prepared By : E A C

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## 4. GLASS INFORMATION (continued)

Exposure	Glass Areas (sqft)					
	Type 1		Type 2		Type 3	
	Area	Shade	Area	Shade	Area	Shade
NE	0.0	0	120.0	1	NA	NA
E	0.0	0	0.0	0	NA	NA
SE	0.0	1	120.0	0	NA	NA
S	0.0	0	0.0	0	NA	NA
SW	0.0	1	120.0	0	NA	NA
W	0.0	0	0.0	0	NA	NA
NW	0.0	1	120.0	0	NA	NA
N	0.0	0	0.0	0	NA	NA
H	0.0	0	0.0	0	NA	NA

\*\*\*\*\*

## 5. INTERNAL LOADS

SPACE DATA	: Floor Area	=	400 sqft	Building Wt. =	M	lb/sqft
PEOPLE	: sqft/person	=	80.0	Total People =		5
	Schedule No.	=	1	Activity Level =		3
LIGHTING	: W/sqft	=	0.00	Total Watts =		0
	Schedule No.	=	2	Wattage Mult. =		1.20
	Fixture Type	=	3 Free-hanging			
OTHER ELECTRIC:	W/sqft	=	4.40	Total Watts =		1,760
	Schedule No.	=	6			
MISC. SENSIBLE:	Load	=	1,000 BTU/hr	Schedule No. =		7
MISC. LATENT	: Load	=	0 BTU/hr	Schedule No. =		1

\*\*\*\*\*

## 6. PARTITIONS, INFILTRATION, GROUND

PARTITIONS (Next to Unconditioned Spaces)			Unconditioned Space Temp.	
Area	U-Value		Cooling	Heating
(sqft)	(BTU/hr/sqft/F)		(deg F or %)	(deg F or %)
Walls	0.0	0.420	90.0 %	30.0 F
Ceilings	0.0	0.420	90.0 %	10.0 F
Floors	0.0	0.570	90.0 %	10.0 F
INFILTRATION			GROUND ELEMENT	
Cooling	: 0.15 CFM/sqft =	60 CFM	Area	: 0.0 sqft
Heating	: 0.28 CFM/sqft =	112 CFM	Perimeter	: 0.0 ft
Typical	: 0.28 CFM/sqft =	112 CFM	Depth	: 0.0 ft

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 2 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 2 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 1 Cooling Only

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	35.0 F	CLOSED
Unoccupied	75.0 F	35.0 F	CLOSED

Weekday : Occupied Period Begins at 6 ; Duration = 17 hrs  
Saturday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Sunday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Design Day : Occupied Period Begins at 6 ; Duration = 17 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 600.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 2 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.80 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 F1 3 -COOLING

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Prepared By : E A C

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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 F1 3 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 1 Cooling Only

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	35.0 F	CLOSED
Unoccupied	75.0 F	35.0 F	CLOSED

Weekday : Occupied Period Begins at 6 ; Duration = 17 hrs  
Saturday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Sunday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Design Day : Occupied Period Begins at 6 ; Duration = 17 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 600.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*



# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.80 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3 -COOLING

04-27-91

Carrier Hourly Analysis Program

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Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved

Static = 0.80 in wg

Efficiency = 54 %

Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050

Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 4 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 1 Cooling Only

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period		Thermostat Setpoints		Ventilation Dampers
		Cooling	Heating	
Occupied		75.0 F	35.0 F	CLOSED
Unoccupied		75.0 F	35.0 F	CLOSED
<hr/>				
Weekday	: Occupied Period Begins at	0 ; Duration		= 24 hrs
Saturday	: Occupied Period Begins at	8 ; Duration		= 10 hrs
Sunday	: Occupied Period Begins at	8 ; Duration		= 10 hrs
Design Day	: Occupied Period Begins at	0 ; Duration		= 24 hrs
<hr/>				

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 600.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM

Minimum ventilation flow rate = 0.00 CFM

Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM

Zone exhaust fan power = 0.0 kW

Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.80 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 5 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 5 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 1 Cooling Only

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Sunday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 800.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 5 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.80 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 6 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 6 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 3 Cooling & Heating  
Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
-----			
Weekday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Saturday	: Occupied Period Begins at 7 ; Duration = 0 hrs		
Sunday	: Occupied Period Begins at 7 ; Duration = 0 hrs		
Design Day	: Occupied Period Begins at 8 ; Duration = 10 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1000.00 CFM  
Heating supply temperature = 110.0 F  
Fan operation for heating = 1 Continuous

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 6 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.80 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 2 Skin Heating Units  
SKIN HEATING UNITS  
Heat source = 1 Baseboard Heaters  
Skin heating trip temperature = 0.0 F



# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 7 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 7 -COOLING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 1 Cooling Only

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	35.0 F	OPEN
Unoccupied	75.0 F	35.0 F	OPEN

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Saturday : Occupied Period Begins at 8 ; Duration = 10 hrs  
Sunday : Occupied Period Begins at 8 ; Duration = 10 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 2000.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 175.00 CFM  
Minimum ventilation flow rate = 175.00 CFM  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 100.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 7 -COOLING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 7:Backward inclined or air foil  
Static = 1.00 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 F1 1 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 F1 1 -HEATING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 1 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 2 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
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## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 2 -HEATING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 2 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 3 -HEATING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
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## \*\*\*\*\* 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

## \*\*\*\*\* 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

## \*\*\*\*\* 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters



# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 4 -HEATING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED

Weekday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Saturday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Sunday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Design Day	: Occupied Period Begins at	0 ; Duration	= 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units

### SPACE HEATING UNITS

Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 5 -HEATING

04-27-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 5 -HEATING  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 2 Space Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 F1 5 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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Page 2 of 2

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 6 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 6 -HEATING  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	CLOSED
Unoccupied	N	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 6 -HEATING  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 F1 2-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 F1 2-OFFICE HEAT  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	80.0 F	CLOSED
Unoccupied	N	80.0 F	CLOSED
-----			
Weekday	: Occupied Period Begins at	6 ; Duration	= 17 hrs
Saturday	: Occupied Period Begins at	7 ; Duration	= 11 hrs
Sunday	: Occupied Period Begins at	7 ; Duration	= 11 hrs
Design Day	: Occupied Period Begins at	6 ; Duration	= 17 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM

Minimum ventilation flow rate = 0.00 CFM

Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM

Zone exhaust fan power = 0.0 kW

Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 2-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*



# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-27-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 3-OFFICE HEAT  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	80.0 F	CLOSED
Unoccupied	N	80.0 F	CLOSED

Weekday : Occupied Period Begins at 6 ; Duration = 17 hrs  
Saturday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Sunday : Occupied Period Begins at 7 ; Duration = 11 hrs  
Design Day : Occupied Period Begins at 6 ; Duration = 17 hrs

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 3-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 4-OFFICE HEAT  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 2 Space Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	80.0 F	CLOSED
Unoccupied	N	80.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Sunday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM

Minimum ventilation flow rate = 0.00 CFM

Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM

Zone exhaust fan power = 0.0 kW

Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 4-OFFICE HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 3 Space Heating Units  
SPACE HEATING UNITS  
Heat source = 1 Baseboard Heaters

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 7 - HEAT

04-27-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 Fl 7 - HEAT  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	68.0 F	OPEN
Unoccupied	110.0 F	68.0 F	OPEN
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Sunday	: Occupied Period Begins at 8 ; Duration = 10 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 2000.00 CFM  
Heating supply temperature = 110.0 F  
Fan operation for heating = 1 Continuous

### VENTILATION AIR

Nominal ventilation flow rate = 175.00 CFM  
Minimum ventilation flow rate = 175.00 CFM  
Damper leak rate = 5 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 100.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 Fl 7 - HEAT  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 7:Backward inclined or air foil  
Static = 1.00 in wg  
Efficiency = 54 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 2 Skin Heating Units  
SKIN HEATING UNITS  
Heat source = 1 Baseboard Heaters  
Skin heating trip temperature = 0.0 F

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 - LIGHTING/MISC  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = #1359 - LIGHTING/MISC  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 3 Cooling & Heating  
Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	110.0 F	35.0 F	CLOSED
Unoccupied	N	35.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 0 hrs  
Saturday : Occupied Period Begins at 0 ; Duration = 0 hrs  
Sunday : Occupied Period Begins at 0 ; Duration = 0 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air flow rate = 1.00 CFM  
Heating supply temperature = 110.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 CFM  
Minimum ventilation flow rate = 0.00 CFM  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : #1359 - LIGHTING/MISC  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.01 in wg  
Efficiency = 100 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*



# AIR SYSTEM SPACE LIST

Name : #1359 - LIGHTING/MISC  
Carrier Hourly Analysis Program  
Prepared By : E A C

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\*\*\*\*\*  
Space Name Qty. | Space Name Qty.  
\*\*\*\*\*

TABLE 1. SPACES IN ZONE 1

1 GROUND FL. - EQUIP. RM.	x 1	10 4TH FL. - PC RM.	x 1
2 GROUND FL. - STORAGE RM.	x 1	11 4TH FL. - STAIR	x 1
3 GROUND FL. - STAIR	x 1	12 5TH FL. - RADIO EQ. RM.	x 1
4 2ND FL. - OFFICE	x 1	13 5TH FL. - STORAGE	x 1
5 2ND FL. - LATRINE	x 1	14 5TH FL. - STAIR	x 1
6 2ND FL. - STAIR	x 1	15 6TH FL. - CONFERENCE RM.	x 1
7 3RD FL. - OFFICE	x 1	16 6TH FL. - LATRINE	x 1
8 3RD FL. - STAIR	x 1	17 6TH FL. - STAIR	x 1
9 4TH FL. - RADAR RM.	x 1	18 7TH FL. - OBSERVATION	x 1

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : #1359 Chiller

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = #1359 Chiller  
Cooling Plant Type = Air Cooled Reciprocating  
Heating Plant Type = User Defined

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
#1359 F1 2 -COOLING	1	#1359 F1 3 -COOLING	1
#1359 F1 4 -COOLING	1	#1359 F1 5 -COOLING	1
#1359 F1 6 -COOLING	1	#1359 F1 7 -COOLING	1

## 3a COOLING PLANT DATA (Air Cooled Reciprocating)

Estimated maximum cooling coil load = 10.96 Ton  
Is an electronic expansion valve used ? Y  
Capacity at 95.0 F outdoor air = 10.60 Ton  
Input power rate at 95.0 F outdoor air = 1.170 kW/Ton  
Is chilled water reset used ? N  
Design leaving water temperature = 44.0 F  
Is hot gas bypass used ? N

## 3b HEATING PLANT DATA (User Defined)

Estimated maximum heating coil load = 9.17 MBH  
Fuel or power source = Electrical  
Nominal plant capacity = 10.0 MBH  
Nominal plant efficiency = 100 %  
Type of heating = Direct

## PART LOAD PERFORMANCE

% Load	Eff. (%)	% Load	Eff. (%)	% Load	Eff. (%)
90 -----	75	60 -----	75	30 -----	75
80 -----	75	50 -----	75	20 -----	75
70 -----	75	40 -----	75	10 -----	75

## 4 PUMP SYSTEM DATA

Chilled water pumping system head = 42.50 ft wg  
Chilled water pumping system delta T = 10.00 F

# PLANT DESCRIPTIONS

Plant : #1359 HEATING

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = #1359 HEATING  
Cooling Plant Type = User Defined  
Heating Plant Type = Remote Source Heating

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
#1359 F1 1 -HEATING	1	#1359 F1 2 -HEATING	1
#1359 F1 3 -HEATING	1	#1359 F1 4 -HEATING	1
#1359 F1 5 -HEATING	1	#1359 F1 6 -HEATING	1
#1359 F1 2-OFFICE HEAT	1	#1359 F1 3-OFFICE HEAT	1
#1359 F1 4-OFFICE HEAT	1	#1359 F1 7 - HEAT	1

\*\*\*\*\*

## 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

## PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90 -----	100	60 -----	100	30 -----	100
80 -----	100	50 -----	100	20 -----	100
70 -----	100	40 -----	100	10 -----	100

\*\*\*\*\*

## 3b HEATING PLANT DATA (Remote Source Heating)

Estimated maximum heating coil load = 151.00 MBH  
(No inputs required)

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

Hot water pumping system head = 0.00 ft wg  
Hot water pumping system delta T = 0.00 F

\*\*\*\*\*

## ELECTRIC RATE DATA

Electric Rate : FED INSTALL RATE NO MIN DEMAND

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. NAME, CURRENCY &amp; TYPE

## NAME

Name of rate schedule = FED INSTALL RATE NO MIN DEMAND

## CURRENCY

Currency name = Dollars

Currency symbol = \$

## TYPE

Type of rate schedule = 2 Complex

Frequency of billing = 1 Monthly

Is seasonal scheduling used ? Y

Is time-of-day scheduling used ? Y

\*\*\*\*\*

## 2. BASIC INFORMATION

## ENERGY CHARGES

Type of energy charge = 1 Declining Block

Number of steps = 1

## ENERGY CHARGES - 2nd METER

Is a second meter used ? N

## DEMAND CHARGES

Is a demand charge used ? Y

Number of steps = 1

## DEMAND DETERMINATION (Which are used?)

Ratchet clause ? N

Trailing window clause ? Y

Minimum kW clause ? N

Power factor multiplier clause ? Y

Power multiplier clause ? N

## MISCELLANEOUS CHARGES

Fixed charge = 0.00 \$

Tax rate = 0.00 %

\*\*\*\*\*

## ELECTRIC RATE DATA

Electric Rate : FED INSTALL RATE NO MIN DEMAND

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## 3. SCHEDULING DATA

## SEASONAL SCHEDULING

Month ->	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Schedule ->	W	W	W	W	W	S	S	S	S	W	W	W

S = Summer      M = Mid-season      W = Winter

## TIME-OF-DAY SCHEDULING

Season	Day	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
Summer	Weekday	N	N	N	N	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	N
Summer	Saturday	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Summer	Sunday	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Winter	Weekday	N	N	N	N	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	N
Winter	Saturday	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Winter	Sunday	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

P = Peak

M = Mid-Peak

N = Normal

O = Off-Peak

\*\*\*\*\*

## 4. ENERGY CHARGES

Step	Season	Period	Block Size	Rate
1	All	All	9999999 kWh	0.02072 (\$/kWh)

\*\*\*\*\*

## 5. ENERGY CHARGES - 2nd METER

(No inputs required)

\*\*\*\*\*

## 6. DEMAND CHARGES

Step	Season	Period	Block Size (kW)	Rate (\$/kW)
1	All	All	999999	10.78000

\*\*\*\*\*

ELECTRIC RATE DATA

Electric Rate : FED INSTALL RATE NO MIN DEMAND

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 3

\*\*\*\*\*

7. DEMAND DETERMINATION

RATCHET CLAUSE

(Not used)

TRAILING WINDOW CLAUSE

Trailing window = 11 months

Trailing window multiplier = 90 %

MINIMUM kW CLAUSE

(Not used)

POWER FACTOR MULTIPLIER CLAUSE

Power factor multiplier = 99.97 %

POWER MULTIPLIER CLAUSE

(Not used)

\*\*\*\*\*

# FUEL RATE DATA

Fuel Rate : REMOTE

04-27-91

Prepared By : E A C

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Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. FUEL RATE DATA

NAME	
Name of rate schedule	= REMOTE
CURRENCY	
Currency name	= Dollars
Currency symbol	= \$
BASIC INFORMATION	
Units of measurement	= MBTU
Conversion factor	= 1000.00000 kBTU/MBTU
Type of rate schedule	= 1 Simple
Flat rate charge	= 9.97000 \$/MBTU

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : #1359

04-27-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = #1359

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? N

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
#1359 Chiller	1	#1359 HEATING	1

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	1	FED INSTALL RATE NO MIN DEMAND	\$
Natural Gas	1	REMOTE	\$
Fuel Oil	1	REMOTE	\$
Propane	1	REMOTE	\$
Remote Source Heating	1	REMOTE	\$
Remote Source Cooling	1	REMOTE	\$

\*\*\*\*\*



# ENERGY BUDGET <A>

Building : #1359 - BASELINE ENERGY

07-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

Page 1 of 1

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	260,988	64.521
Heating Loads *	155,483	38.438

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	32,794	8.107	32,794	8.107
Cooling Plants	53,681	13.271	53,681	13.271
Heating Plants	156,411	38.668	156,411	38.668
Pumps	6,478	1.602	6,478	1.602
>> HVAC Total	249,364	61.647	249,364	61.647
Lights	75,790	18.737	75,790	18.737
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	340,574	84.196	340,574	84.196
>> GRAND TOTAL	589,938	145.844	589,938	145.844

- \* Notes: 1. Site energy is the actual energy consumed.  
2. Source energy accounts for electrical generating inefficiencies. For this study:  
Electric generating efficiency =100.0 %  
3. Energy per unit floor area is based on the gross building floor area. For this building:  
Gross floor area = 4,045 sqft  
Conditioned floor area = 4,045 sqft  
4. Annual cooling load is the sum of all cooling plant loads.  
5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

# ENERGY BUDGET <A>

Building : #1359 LIGHTING/MISC  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

07-29-91  
 6100190202

Page 1 of 1

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	0	0.000

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	0	0.000	0	0.000
Pumps	0	0.000	0	0.000
>> HVAC Total	0	0.000	0	0.000
Lights	59,470	20.721	59,470	20.721
Other Electric	160,966	56.086	160,966	56.086
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	220,436	76.807	220,436	76.807
>> GRAND TOTAL	220,436	76.807	220,436	76.807

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 2,870 sqft  
     Conditioned floor area = 2,870 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

## ELECTRIC POWER COSTS

Building : #1359 - BASELINE ENERGY

07-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	202	317	0	0	519
Feb	182	317	0	0	499
Mar	204	317	0	0	521
Apr	205	317	0	0	522
May	231	317	0	0	548
June	249	332	0	0	581
July	272	352	0	0	624
Aug	270	343	0	0	613
Sept	227	317	0	0	544
Oct	217	317	0	0	534
Nov	196	317	0	0	513
Dec	199	317	0	0	515
Tot.	2,655	3,879	0	0	6,535

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	519	9,772	0.05315
Feb	499	8,807	0.05670
Mar	521	9,845	0.05291
Apr	522	9,888	0.05277
May	548	11,155	0.04913
June	581	12,021	0.04835
July	624	13,141	0.04752
Aug	613	13,053	0.04699
Sept	544	10,951	0.04966
Oct	534	10,482	0.05096
Nov	513	9,450	0.05426
Dec	515	9,582	0.05379
Tot.	6,535	128,147	0.05099

\*\*\*\*\*

# REMOTE HEATING COSTS

Building : #1359-BASELINE-REMOTE(\$)  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

08-29-91  
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\*\*\*\*\*  
 TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)  
 \*\*\*\*\*

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	369	0	0	369
Feb	283	0	0	283
Mar	186	0	0	186
Apr	67	0	0	67
May	24	0	0	24
June	11	0	0	11
July	8	0	0	8
Aug	9	0	0	9
Sept	15	0	0	15
Oct	55	0	0	55
Nov	170	0	0	170
Dec	325	0	0	325
Tot.	1,522	0	0	1,522

\*\*\*\*\*  
 TABLE 2. MONTHLY TOTALS  
 \*\*\*\*\*

Month	Charges (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	369	37	9.97000
Feb	283	28	9.97000
Mar	186	19	9.97000
Apr	67	7	9.97000
May	24	2	9.97000
June	11	1	9.97000
July	8	1	9.97000
Aug	9	1	9.97000
Sept	15	2	9.97000
Oct	55	6	9.97000
Nov	170	17	9.97000
Dec	325	33	9.97000
Tot.	1,522	153	9.97000

BUILDING 1359

**ECO #1 - Radiator Control Valves**

**Description -** Radiators and unit heaters have steam flowing through them even when the thermostat set point is met, thus overheating the respective spaces. Control valves will stop the flow of steam when the thermostat set point is reached.

Energy Saved	= 25 MBTU/year
Cost	= \$945 (incl. SIOH)
SIR	= 3.3

# ENERGY BUDGET <A>

Building : #1359-Control Valves  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

07-29-91  
 6100190202

Page 1 of 1

\*\*\*\*\*  
 TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	260,988	64.521
Heating Loads *	131,054	32.399

\*\*\*\*\*  
 TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	32,780	8.104	32,780	8.104
Cooling Plants	53,681	13.271	53,681	13.271
Heating Plants	131,981	32.628	131,981	32.628
Pumps	6,478	1.602	6,478	1.602
>> HVAC Total	224,921	55.605	224,921	55.605
Lights	75,790	18.737	75,790	18.737
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	340,574	84.196	340,574	84.196
>> GRAND TOTAL	565,495	139.801	565,495	139.801

\*\*\*\*\*  
 \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.  
 \*\*\*\*\*

## ELECTRIC POWER COSTS

Building : #1359-Control Valves

07-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	202	317	0	0	519
Feb	182	317	0	0	499
Mar	204	317	0	0	521
Apr	205	317	0	0	522
May	231	317	0	0	548
June	249	332	0	0	581
July	272	352	0	0	624
Aug	270	343	0	0	613
Sept	227	317	0	0	544
Oct	217	317	0	0	534
Nov	196	317	0	0	513
Dec	199	317	0	0	515
Tot.	2,655	3,879	0	0	6,535

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	519	9,772	0.05315
Feb	499	8,807	0.05670
Mar	521	9,844	0.05291
Apr	522	9,887	0.05277
May	548	11,155	0.04913
June	581	12,021	0.04835
July	624	13,141	0.04752
Aug	613	13,053	0.04699
Sept	544	10,950	0.04966
Oct	534	10,481	0.05096
Nov	513	9,450	0.05426
Dec	515	9,582	0.05379
Tot.	6,535	128,143	0.05099

\*\*\*\*\*

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Install thermostatic radiator control valves

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install valves	4	each	\$10	\$40	\$94	\$376	\$416
Remove exist. manual valve	4	each	\$30	\$120	---	---	\$120
Install fittings	8	each	\$15	\$120	\$1	\$8	\$128
SUB-TOTAL:				\$280		\$384	\$664
labor Markup: 21%				\$59		---	\$59
Taxes: 4.5%				---		\$17	\$17
SUB-TOTAL:				\$339		\$401	\$740
Overhead: 10%				\$34		\$40	\$74
SUB-TOTAL:				\$373		\$441	\$814
Profit: 10%				\$37		\$44	\$81
TOTAL:				\$410		\$486	\$896



## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Radiator Control Val  
 Prepared By : E A C, PC BURKE, VA.  
 E20-II Advanced Economic Analysis Program  
 LCCID - based (version 1, level 35).

09-26-91  
 60901891.00  
 Page 1 of 2

## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 15 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	896
SIOH costs	\$	49
Design costs	\$	54
Energy credit calc	\$	899
Salvage value cost	-\$	0
Total investment cost	\$	899

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	0	0	8.78	0
DIST	0.00	0	0	12.34	0
RESID	9.97	25	244	12.05	2943
NAT G	0.00	0	0	12.48	0
COAL	0.00	0	0	10.01	0
TOTAL		25	244		\$ 2943

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
------	----------------------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-) \$ 0

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Radiator Control Val

09-26-91

Prepared By : E A C, PC BURKE, VA.

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E20-II Advanced Economic Analysis Program

Page 2 of 2

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\*\*\*\*\*

## NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*

## DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	0
---------------------------	--	--	----	---

Non-energy one-time savings			\$	0
-----------------------------	--	--	----	---

Total non-energy savings			\$	0
--------------------------	--	--	----	---

\*\*\*\*\*

## PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	971
---------------------	--	--	----	-----

Non-energy qualification not applicable.

First year Dollar savings			\$	244
---------------------------	--	--	----	-----

Total net discounted savings			\$	2943
------------------------------	--	--	----	------

Discounted savings ratio				3.27
--------------------------	--	--	--	------

Simple payback period (years)				3.68
-------------------------------	--	--	--	------

\*\*\*\*\*

BUILDING 1359

**ECO #2 - Ceiling Insulation**

**Description -** The existing heat loss/heat gain through the roof/ceiling assembly will be reduced by installing additional R-19 insulation, improving the U-value from 0.22 to 0.0425 BTU/hr.- Sq. Ft. - °F.

Energy Saved	= 9 MBTU/year
Cost	= \$530 (incl. SIOH)
SIR	= 3.2

## ENERGY BUDGET &lt;A&gt;

Building : #1359-Ceiling Insulation  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

07-29-91  
 6100190202

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\*\*\*\*\*  
TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	257,283	63.605
Heating Loads *	124,375	30.748

\*\*\*\*\*  
TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	31,920	7.891	31,920	7.891
Cooling Plants	52,719	13.033	52,719	13.033
Heating Plants	125,302	30.977	125,302	30.977
Pumps	6,478	1.602	6,478	1.602
>> HVAC Total	216,420	53.503	216,420	53.503
Lights	75,790	18.737	75,790	18.737
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	340,574	84.196	340,574	84.196
>> GRAND TOTAL	556,994	137.699	556,994	137.699

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

1359-96

## ELECTRIC POWER COSTS

Building : #1359-Ceiling Insulation  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

07-29-91  
 6100190202

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\*\*\*\*\*  
 TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)  
 \*\*\*\*\*

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	202	314	0	0	516
Feb	182	314	0	0	496
Mar	204	314	0	0	518
Apr	205	314	0	0	519
May	230	314	0	0	545
June	247	330	0	0	577
July	269	349	0	0	619
Aug	268	341	0	0	609
Sept	226	314	0	0	540
Oct	217	314	0	0	531
Nov	196	314	0	0	510
Dec	198	314	0	0	512
Tot.	2,644	3,848	0	0	6,492

\*\*\*\*\*  
 TABLE 2. MONTHLY TOTALS  
 \*\*\*\*\*

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	516	9,748	0.05296
Feb	496	8,786	0.05649
Mar	518	9,843	0.05265
Apr	519	9,877	0.05254
May	545	11,113	0.04900
June	577	11,916	0.04839
July	619	13,000	0.04758
Aug	609	12,939	0.04704
Sept	540	10,904	0.04954
Oct	531	10,478	0.05071
Nov	510	9,447	0.05399
Dec	512	9,558	0.05360
Tot.	6,492	127,609	0.05087

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Add insulation above drop ceiling

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install R-19 insulation	676	sq. ft.	\$0.17	\$115	\$0.39	\$264	\$379
SUB-TOTAL:				\$115		\$264	\$379
labor Markup: 21%				\$24		---	\$24
taxes: 4.5%				---		\$12	\$12
SUB-TOTAL:				\$139		\$276	\$415
Overhead: 10%				\$14		\$28	\$41
SUB-TOTAL:				\$153		\$303	\$456
Profit: 10%				\$15		\$30	\$46
TOTAL:				\$168		\$333	\$502

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Ceiling Insulation

09-26-91

Prepared By : E A C, PC BURKE, VA.

60901891.00

E20-II Advanced Economic Analysis Program

Page 1 of 2

LCCID - based (version 1, level 35).

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## STUDY IDENTIFICATION BLOCK

-----

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

-----

\*\*\*\*\*

## KEY STUDY DATES

-----

ECIP Economic Life : 25 (years)

-----

\*\*\*\*\*

## INVESTMENT COST SUMMARY

-----

Construction cost	\$	502
SIOH costs	\$	28
Design costs	\$	30
Energy credit calc	\$	504
Salvage value cost	-\$	0
Total investment cost	\$	504

-----

\*\*\*\*\*

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	2	12	11.37	131
DIST	0.00	0	0	17.06	0
RESID	9.97	7	66	16.85	1109
NAT G	0.00	0	0	17.52	0
COAL	0.00	0	0	13.34	0
TOTAL		9	77		\$ 1240

-----

\*\*\*\*\*

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Demand Charges	31	11.65	361
Total discounted savings(+) / costs(-)			\$ 361

-----

\*\*\*\*\*

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Ceiling Insulation  
 Prepared By : E A C, PC BURKE, VA.  
 E20-II Advanced Economic Analysis Program  
 LCCID - based (version 1, level 35).

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\*\*\*\*\*  
 NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	---------------------	------	-----------------	--------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*  
 DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	361
Non-energy one-time savings			\$	0
Total non-energy savings			\$	361

\*\*\*\*\*  
 PROJECT QUALIFICATION TESTS

Project non-energy qualification test.				
Energy savings calc			\$	409
Non-energy qualification not applicable.				
First year Dollar savings			\$	108
Total net discounted savings			\$	1601
Discounted savings ratio				3.18
Simple payback period (years)				4.65

\*\*\*\*\*



BUILDING 1359

**ECO #3 - Weatherstripping**

Description - The building doors and windows are loose and have lost effective sealing.  
Weatherstripping will cut down on infiltration through them and will help in saving energy.

Energy Saved	= 21 MBTU/year
Cost	= \$723 (incl. SIOH)
SIR	= 1.7

# ENERGY BUDGET <A>

Building : #1359-Weatherstripping  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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 6100190202

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	263,048	65.030
Heating Loads *	103,327	25.544

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	31,694	7.835	31,694	7.835
Cooling Plants	53,186	13.149	53,186	13.149
Heating Plants	103,984	25.707	103,984	25.707
Pumps	6,606	1.633	6,606	1.633
>> HVAC Total	195,470	48.324	195,470	48.324
Lights	75,790	18.737	75,790	18.737
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	340,574	84.196	340,574	84.196
>> GRAND TOTAL	536,045	132.520	536,045	132.520

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

## ELECTRIC POWER COSTS

Building : #1359-Weatherstripping

08-29-91

Site : FT. BELVOIR, VIRGINIA

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Prepared By : E A C, PC BURKE, VA.

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	201	310	0	0	510
Feb	181	310	0	0	491
Mar	204	310	0	0	514
Apr	206	310	0	0	516
May	231	310	0	0	541
June	246	327	0	0	573
July	267	344	0	0	611
Aug	266	336	0	0	603
Sept	226	311	0	0	537
Oct	219	310	0	0	528
Nov	195	310	0	0	505
Dec	197	310	0	0	507
Tot.	2,640	3,797	0	0	6,437

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	510	9,682	0.05272
Feb	491	8,743	0.05616
Mar	514	9,833	0.05223
Apr	516	9,942	0.05188
May	541	11,165	0.04847
June	573	11,889	0.04823
July	611	12,886	0.04743
Aug	603	12,855	0.04689
Sept	537	10,916	0.04920
Oct	528	10,548	0.05009
Nov	505	9,433	0.05356
Dec	507	9,509	0.05330
Tot.	6,437	127,401	0.05052

\*\*\*\*\*

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Weatherstrip around windows  
and first floor door

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Weatherstrip around windows	12	each	\$24	\$288	\$8	\$96	\$384
Weatherstrip door	1	each	\$65	\$65	\$37	\$37	\$102
SUB-TOTAL:				\$353		\$133	\$486
Labor Markup: 21%				\$74		---	\$74
Taxes: 4.5%				---		\$6	\$6
UB-TOTAL:				\$427		\$139	\$566
Overhead: 10%				\$43		\$14	\$57
SUB-TOTAL:				\$470		\$153	\$623
Profit: 10%				\$47		\$15	\$62
TOTAL:				\$517		\$168	\$685

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Weatherstripping  
 Prepared By : E A C, PC BURKE, VA.  
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## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 5 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	685
SIOH costs	\$	38
Design costs	\$	0
Energy credit calc	\$	651
Salvage value cost	-\$	0
Total investment cost	\$	651

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	0	0	3.95	0
DIST	0.00	0	0	4.65	0
RESID	9.97	21	212	4.34	922
NAT G	0.00	0	0	4.47	0
COAL	0.00	0	0	4.27	0
TOTAL		21	212		\$ 922

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Demand Charges	51	4.10	209
Total discounted savings(+) / costs(-)			\$ 209

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Weatherstripping  
 Prepared By : E A C, PC BURKE, VA.  
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\*\*\*\*\*  
 NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	---------------------	------	-----------------	--------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*  
 DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	209
Non-energy one-time savings			\$	0
Total non-energy savings			\$	209

\*\*\*\*\*  
 PROJECT QUALIFICATION TESTS

Project non-energy qualification test.				
Energy savings calc			\$	304
Non-energy qualification not applicable.				
First year Dollar savings			\$	263
Total net discounted savings			\$	1131
Discounted savings ratio				1.74
Simple payback period (years)				2.47

\*\*\*\*\*

## BUILDING 1359

### ECO #4 - Night Set-Back

Description - The building does not have any night set-back controls and, as such, wastes energy by maintaining the same comfort conditions during unoccupied hours as those during occupied periods. Night set-backs will allow the conditions to slide to less stringent conditions, thus saving energy.

Energy Saved	= 20 MBTU/year
Cost	= \$1188 (incl. SIOH)
SIR	= 1.4

## ENERGY BUDGET &lt;A&gt;

Building : #1359-Night setback  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	226,409	55.972
Heating Loads *	96,666	23.898

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	25,849	6.390	25,849	6.390
Cooling Plants	45,979	11.367	45,979	11.367
Heating Plants	96,696	23.905	96,696	23.905
Pumps	6,606	1.633	6,606	1.633
>> HVAC Total	175,130	43.295	175,130	43.295
Lights	75,790	18.737	75,790	18.737
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	340,574	84.196	340,574	84.196
>> GRAND TOTAL	515,704	127.492	515,704	127.492

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.



## ELECTRIC POWER COSTS

Building : #1359-Night setback

08-29-91

Site : FT. BELVOIR, VIRGINIA

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Prepared By : E A C, PC BURKE, VA.

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	194	310	0	0	504
Feb	176	310	0	0	486
Mar	200	310	0	0	510
Apr	202	310	0	0	512
May	223	310	0	0	533
June	234	327	0	0	561
July	250	344	0	0	595
Aug	253	336	0	0	589
Sept	215	311	0	0	526
Oct	214	310	0	0	524
Nov	193	310	0	0	503
Dec	191	310	0	0	501
Tot.	2,545	3,797	0	0	6,342

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	504	9,386	0.05373
Feb	486	8,486	0.05723
Mar	510	9,656	0.05280
Apr	512	9,752	0.05249
May	533	10,768	0.04949
June	561	11,271	0.04974
July	595	12,086	0.04920
Aug	589	12,191	0.04831
Sept	526	10,375	0.05069
Oct	524	10,347	0.05066
Nov	503	9,301	0.05403
Dec	501	9,220	0.05432
Tot.	6,342	122,839	0.05163

\*\*\*\*\*

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Install setback thermostats and  
outside air damper control on AHU

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install setback thermostat	5	each	\$24	\$120	\$64	\$320	\$440
Remove thermostat	5	each	\$15	\$75	---	---	\$75
Motorized damper	1	each	\$25	\$25	\$120	\$120	\$145
Interlock control	1	each	\$25	\$25	\$167	\$167	\$192
SUB-TOTAL:				\$245		\$607	\$852
Labor Markup: 21%				\$51		---	\$51
Taxes: 4.5%				---		\$27	\$27
SUB-TOTAL:				\$296		\$634	\$931
Overhead: 10%				\$30		\$63	\$93
SUB-TOTAL:				\$326		\$698	\$1,024
Profit: 10%				\$33		\$70	\$102
TOTAL:				\$359		\$768	\$1,126

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Night Setback

Prepared By : E A C, PC BURKE, VA.

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## STUDY IDENTIFICATION BLOCK

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Project Title : ESOS

Installation Name : FORT BELVOIR, BLDG 1359

Project Number : DACA-31-89-C-0198

Fiscal Year : 1991

Name of Analyst : EAC

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## KEY STUDY DATES

-----

ECIP Economic Life : 15 (years)

-----

\*\*\*\*\*

## INVESTMENT COST SUMMARY

-----

Construction cost	\$	1126
SIOH costs	\$	62
Design costs	\$	68
Energy credit calc	\$	1130
Salvage value cost	-\$	0
Total investment cost	\$	1130

-----

\*\*\*\*\*

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	13	77	8.78	677
DIST	0.00	0	0	12.34	0
RESID	9.97	7	73	12.05	877
NAT G	0.00	0	0	12.48	0
COAL	0.00	0	0	10.01	0
TOTAL		20	150		\$ 1554

-----

\*\*\*\*\*

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
No cost items.			
Total discounted savings(+) / costs(-)			\$ 0

-----

\*\*\*\*\*

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Night Setback

09-26-91

Prepared By : E A C, PC BURKE, VA.

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\*\*\*\*\*  
NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	---------------------	------	-----------------	--------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*  
DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	0
---------------------------	--	--	----	---

Non-energy one-time savings			\$	0
-----------------------------	--	--	----	---

Total non-energy savings			\$	0
--------------------------	--	--	----	---

\*\*\*\*\*  
PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	513
---------------------	--	--	----	-----

Non-energy qualification not applicable.

First year Dollar savings			\$	150
---------------------------	--	--	----	-----

Total net discounted savings			\$	1554
------------------------------	--	--	----	------

Discounted savings ratio				1.37
--------------------------	--	--	--	------

Simple payback period (years)				7.54
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\*\*\*\*\*

BUILDING 1359

**ECO #5 - Reflectors**

Description - Fluorescent light fixtures on the third floor are open type fixtures. Reflectors for these fixtures will generate both lighting and cooling costs.

Energy Saved	= 4 MBTU/year
Cost	= \$768 (incl. SIOH)
SIR	= 1.3

## ENERGY BUDGET &lt;A&gt;

Building : #1359-Reflectors  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	222,345	54.968
Heating Loads *	97,636	24.137

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	25,849	6.390	25,849	6.390
Cooling Plants	45,224	11.180	45,224	11.180
Heating Plants	97,665	24.145	97,665	24.145
Pumps	6,606	1.633	6,606	1.633
>> HVAC Total	175,345	43.348	175,345	43.348
Lights	64,643	15.981	64,643	15.981
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	329,428	81.441	329,428	81.441
>> GRAND TOTAL	504,772	124.789	504,772	124.789

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

## ELECTRIC POWER COSTS

Building : #1359-Reflectors  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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\*\*\*\*\*  
 TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)  
 \*\*\*\*\*

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	189	302	0	0	491
Feb	171	302	0	0	473
Mar	194	302	0	0	496
Apr	196	302	0	0	498
May	217	302	0	0	519
June	227	319	0	0	546
July	244	336	0	0	580
Aug	246	328	0	0	574
Sept	209	303	0	0	512
Oct	208	302	0	0	510
Nov	187	302	0	0	489
Dec	185	302	0	0	488
Tot.	2,473	3,704	0	0	6,177

\*\*\*\*\*  
 TABLE 2. MONTHLY TOTALS  
 \*\*\*\*\*

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	491	9,108	0.05391
Feb	473	8,232	0.05744
Mar	496	9,365	0.05300
Apr	498	9,466	0.05266
May	519	10,465	0.04961
June	546	10,972	0.04978
July	580	11,777	0.04924
Aug	574	11,873	0.04835
Sept	512	10,089	0.05073
Oct	510	10,043	0.05082
Nov	489	9,019	0.05424
Dec	488	8,943	0.05452
Tot.	6,177	119,351	0.05176

1359-114

# REMOTE HEATING COSTS

Building : #1359-REFLECT-REMOTE (\$)  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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\*\*\*\*\*  
 TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)  
 \*\*\*\*\*

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	242	0	0	242
Feb	180	0	0	180
Mar	108	0	0	108
Apr	38	0	0	38
May	19	0	0	19
June	11	0	0	11
July	9	0	0	9
Aug	10	0	0	10
Sept	15	0	0	15
Oct	35	0	0	35
Nov	99	0	0	99
Dec	206	0	0	206
Tot.	973	0	0	973

\*\*\*\*\*  
 TABLE 2. MONTHLY TOTALS  
 \*\*\*\*\*

Month	Charges, (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	242	24	9.97000
Feb	180	18	9.97000
Mar	108	11	9.97000
Apr	38	4	9.97000
May	19	2	9.97000
June	11	1	9.97000
July	9	1	9.97000
Aug	10	1	9.97000
Sept	15	1	9.97000
Oct	35	3	9.97000
Nov	99	10	9.97000
Dec	206	21	9.97000
Tot.	973	98	9.97000



## ENERGY BUDGET &lt;A&gt;

Building : #1359 LIGHTING-REFLECTOR  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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\*\*\*\*\*  
TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	0	0.000

\*\*\*\*\*  
TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	0	0.000	0	0.000
Pumps	0	0.000	0	0.000
>> HVAC Total	0	0.000	0	0.000
Lights	53,897	18.779	53,897	18.779
Other Electric	160,966	56.086	160,966	56.086
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	214,863	74.865	214,863	74.865
>> GRAND TOTAL	214,863	74.865	214,863	74.865

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 2,870 sqft  
     Conditioned floor area = 2,870 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Install fluorescent fixture reflectors, third floor

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install reflectors	3	each	\$75	\$225	\$105	\$315	\$540
SUB-TOTAL:				\$225		\$315	\$540
Labor Markup: 21%				\$47	---		\$47
Taxes: 4.5%				---		\$14	\$14
SUB-TOTAL:				\$272		\$329	\$601
Overhead: 10%				\$27		\$33	\$60
SUB-TOTAL:				\$299		\$362	\$662
Profit: 10%				\$30		\$36	\$66
TOTAL:				\$329		\$398	\$728

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Reflectors

Prepared By : E A C, PC BURKE, VA.

09-26-91

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## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 15 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	728
SIOH costs	\$	40
Design costs	\$	0
Energy credit calc	\$	691
Salvage value cost	-\$	0
Total investment cost	\$	691

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	6	38	8.78	336
DIST	0.00	0	0	12.34	0
RESID	9.97	-2	-20	12.05	-240
NAT G	0.00	0	0	12.48	0
COAL	0.00	0	0	10.01	0
TOTAL		4	18	\$	95

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Demand Charges	93	9.11	847
Total discounted savings(+) / costs(-)		\$	847

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Reflectors

09-26-91

Prepared By : E A C, PC BURKE, VA.

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\*\*\*\*\*  
NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*  
DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	847
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Non-energy one-time savings			\$	0
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Total non-energy savings			\$	847
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\*\*\*\*\*  
PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	32
---------------------	--	--	----	----

Non-energy savings-to-investment ratio				0.18
--	--	--	--	------

(SIR &lt; 1) Project does not qualify.

First year Dollar savings			\$	111
---------------------------	--	--	----	-----

Total net discounted savings			\$	943
------------------------------	--	--	----	-----

Discounted savings ratio				1.36
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Simple payback period (years)				6.21
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\*\*\*\*\*

BUILDING 1359

**ECO #6 - Occupancy Sensors**

Description - The lights in the sixth floor conference room stay on for long periods.  
Occupancy sensors are proposed to reduce lighting and cooling costs.

Energy Saved	= 1 MBTU/year
Cost	= \$121 (incl. SIOH)
SIR	= 0.5

## ENERGY BUDGET &lt;A&gt;

Building : #1359-OCCUPANCY SENSORS  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	221,947	54.870
Heating Loads *	97,648	24.140

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	25,849	6.390	25,849	6.390
Cooling Plants	45,156	11.163	45,156	11.163
Heating Plants	97,681	24.149	97,681	24.149
Pumps	6,606	1.633	6,606	1.633
>> HVAC Total	175,292	43.336	175,292	43.336
Lights	63,892	15.795	63,892	15.795
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	328,677	81.255	328,677	81.255
>> GRAND TOTAL	503,969	124.591	503,969	124.591

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

## ELECTRIC POWER COSTS

Building : #1359-OCCUPANCY SENSORS

08-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	188	302	0	0	490
Feb	170	302	0	0	472
Mar	194	302	0	0	495
Apr	196	302	0	0	497
May	216	302	0	0	518
June	227	318	0	0	545
July	244	335	0	0	579
Aug	246	327	0	0	573
Sept	209	302	0	0	511
Oct	208	302	0	0	509
Nov	186	302	0	0	488
Dec	185	302	0	0	487
Tot.	2,468	3,697	0	0	6,165

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	490	9,088	0.05392
Feb	472	8,214	0.05746
Mar	495	9,345	0.05301
Apr	497	9,446	0.05266
May	518	10,444	0.04961
June	545	10,951	0.04977
July	579	11,756	0.04924
Aug	573	11,851	0.04835
Sept	511	10,069	0.05072
Oct	509	10,022	0.05083
Nov	488	9,000	0.05425
Dec	487	8,928	0.05452
Tot.	6,165	119,115	0.05176

\*\*\*\*\*

ENERGY BUDGET <A>

Building : #1359-LIGHTING-OCC SENSO  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

08-29-91  
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\*\*\*\*\*  
 TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	0	0.000

\*\*\*\*\*  
 TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	0	0.000	0	0.000
Pumps	0	0.000	0	0.000
>> HVAC Total	0	0.000	0	0.000
Lights	53,146	18.518	53,146	18.518
Other Electric	160,966	56.086	160,966	56.086
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	214,112	74.604	214,112	74.604
>> GRAND TOTAL	214,112	74.604	214,112	74.604

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 2,870 sqft  
     Conditioned floor area = 2,870 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.



# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Install occupancy sensor for conference room

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install sensor	1	each	\$25	\$25	\$60	\$60	\$85
Remove existing switch	1	each	\$2	\$2	---	---	\$2
SUB-TOTAL:				\$27		\$60	\$87
Labor Markup: 21%				\$6		---	\$6
Taxes: 4.5%				---		\$3	\$3
SUB-TOTAL:				\$33		\$63	\$95
Overhead: 10%				\$3		\$6	\$10
SUB-TOTAL:				\$36		\$69	\$105
Profit: 10%				\$4		\$7	\$10
TOTAL:				\$40		\$76	\$115

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Occupancy Sensors  
 Prepared By : E A C, PC BURKE, VA.  
 E20-II Advanced Economic Analysis Program  
 LCCID - based (version 1, level 35).

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## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 10 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	115
SIOH costs	\$	6
Design costs	\$	0
Energy credit calc	\$	109
Salvage value cost	-\$	0
Total investment cost	\$	109

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	0	1	6.72	8
DIST	0.00	0	0	8.77	0
RESID	9.97	0	0	8.40	0
NAT G	0.00	0	0	8.68	0
COAL	0.00	0	0	7.53	0
TOTAL		0	1		\$ 8

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Demand Charges	7	7.02	49
Total discounted savings(+) / costs(-)			\$ 49

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Occupancy Sensors  
 Prepared By : E A C, PC BURKE, VA.  
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\*\*\*\*\*  
 NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	---------------------	------	-----------------	--------------------

No cost items.

Total discounted savings(+) / costs(-)			\$	0
--	--	--	----	---

\*\*\*\*\*  
 DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings			\$	49
Non-energy one-time savings			\$	0
Total non-energy savings			\$	49

\*\*\*\*\*  
 PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc			\$	3
Non-energy savings-to-investment ratio				0.10
(SIR < 1) Project does not qualify.				
First year Dollar savings			\$	8
Total net discounted savings			\$	57
Discounted savings ratio				0.53
(SIR < 1) Project does not qualify.				
Simple payback period (years)				13.26

\*\*\*\*\*

BUILDING 1359

**ECO #7 - Wall Insulation**

Description - The wall assembly does not have any insulation. A proposed exterior wall system will provide 2" wall insulation (R-11), which will improve U-value from 0.4 to 0.074 BTU/hr. - Sq. Ft. - °F. This improvement should provide energy savings by reducing heat loss and heat gain through the walls.

Energy Saved	= 31 MBTU/year
Cost	= \$36,826 (incl. SIOH)
SIR	= 0.2

## ENERGY BUDGET &lt;A&gt;

Building : #1359-WALL INSULATION

08-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	225,406	55.725
Heating Loads *	68,256	16.874

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	25,402	6.280	25,402	6.280
Cooling Plants	44,751	11.063	44,751	11.063
Heating Plants	68,256	16.874	68,256	16.874
Pumps	6,945	1.717	6,945	1.717
>> HVAC Total	145,354	35.934	145,354	35.934
Lights	63,892	15.795	63,892	15.795
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	328,677	81.255	328,677	81.255
>> GRAND TOTAL	474,031	117.189	474,031	117.189

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

## ELECTRIC POWER COSTS

Building : #1359-WALL INSULATION

08-29-91

Site : FT. BELVOIR, VIRGINIA

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

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TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	188	296	0	0	484
Feb	171	296	0	0	466
Mar	196	296	0	0	491
Apr	197	296	0	0	493
May	216	296	0	0	512
June	224	313	0	0	537
July	240	329	0	0	568
Aug	242	321	0	0	564
Sept	207	299	0	0	506
Oct	209	296	0	0	505
Nov	189	296	0	0	484
Dec	186	296	0	0	482
Tot.	2,464	3,628	0	0	6,092

\*\*\*\*\*  
TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	484	9,091	0.05325
Feb	466	8,242	0.05660
Mar	491	9,437	0.05206
Apr	493	9,512	0.05181
May	512	10,418	0.04910
June	537	10,823	0.04965
July	568	11,561	0.04914
Aug	564	11,684	0.04823
Sept	506	10,009	0.05056
Oct	505	10,079	0.05006
Nov	484	9,103	0.05320
Dec	482	8,967	0.05370
Tot.	6,092	118,926	0.05122

\*\*\*\*\*

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Add 2" of insulation to exterior walls

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install exterior insulation	4259	sq. ft.	\$3.18	\$13,543	\$2.80	\$11,924	\$25,467
SUB-TOTAL:				\$13,543		\$11,924	\$25,467
Labor Markup: 21%				\$2,844		---	\$2,844
Taxes: 4.5%				---		\$537	\$537
SUB-TOTAL:				\$16,387		\$12,461	\$28,848
Overhead: 10%				\$1,639		\$1,246	\$2,885
SUB-TOTAL:				\$18,025		\$13,707	\$31,732
Profit: 10%				\$1,803		\$1,371	\$3,173
TOTAL:				\$19,828		\$15,078	\$34,906

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Wall Insulation  
 Prepared By : E A C, PC BURKE, VA.  
 E20-II Advanced Economic Analysis Program  
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## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 25 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	34906
SIOH costs	\$	1920
Design costs	\$	2094
Energy credit calc	\$	35028
Salvage value cost	-\$	0
Total investment cost	\$	35028

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	1	7	11.37	76
DIST	0.00	0	0	17.06	0
RESID	9.97	29	293	16.85	4939
NAT G	0.00	0	0	17.52	0
COAL	0.00	0	0	13.34	0
TOTAL		31	300		\$ 5015

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Demand Charges	69	11.65	804
Total discounted savings(+) / costs(-)			\$ 804



## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Wall Insulation

09-26-91

Prepared By : E A C, PC BURKE, VA.

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 NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

-----  
 No cost items.

Total discounted savings(+) / costs(-)				\$ 0
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\*\*\*\*\*  
 DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings				\$ 804
---------------------------	--	--	--	--------

Non-energy one-time savings				\$ 0
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Total non-energy savings				\$ 804
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\*\*\*\*\*  
 PROJECT QUALIFICATION TESTS

-----  
 Project non-energy qualification test.

Energy savings calc				\$ 1655
---------------------	--	--	--	---------

Non-energy qualification not applicable.

First year Dollar savings				\$ 369
---------------------------	--	--	--	--------

Total net discounted savings				\$ 5819
------------------------------	--	--	--	---------

Discounted savings ratio				0.17
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(SIR < 1) Project does not qualify.

Simple payback period (years)				94.98
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BUILDING 1359

**ECO #8 - Double Insulated Glass**

**Description -** This is another proposed building envelope improvement to reduce energy usage. Existing single galss windows (U-value 1.0) will be replaced by double glassed windows with a U-value of 0.58.

Energy Saved	= 4 MBTU/year
Cost	= \$5,129 (incl. SIOH)
SIR	= 0.2

## ENERGY BUDGET &lt;A&gt;

Building : #1359-DOUBLE GLAZED WIND  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

08-29-91  
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\*\*\*\*\*  
TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	226,109	55.898
Heating Loads *	63,855	15.786

\*\*\*\*\*  
TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	25,379	6.274	25,379	6.274
Cooling Plants	44,793	11.074	44,793	11.074
Heating Plants	63,855	15.786	63,855	15.786
Pumps	6,978	1.725	6,978	1.725
>> HVAC Total	141,005	34.859	141,005	34.859
Lights	63,892	15.795	63,892	15.795
Other Electric	264,784	65.460	264,784	65.460
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	0	0.000	0	0.000
>> Non-HVAC Total	328,677	81.255	328,677	81.255
>> GRAND TOTAL	469,682	116.114	469,682	116.114

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,045 sqft  
     Conditioned floor area = 4,045 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

## ELECTRIC POWER COSTS

Building : #1359-DOUBLE GLAZED WIND  
 Site : FT. BELVOIR, VIRGINIA  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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\*\*\*\*\*  
TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)  
\*\*\*\*\*

Month	Energy Charges	Demand Charges	Fixed Charges	Taxes	Totals
Jan	188	295	0	0	484
Feb	171	295	0	0	466
Mar	196	295	0	0	491
Apr	197	295	0	0	492
May	216	295	0	0	511
June	224	313	0	0	537
July	239	328	0	0	567
Aug	242	321	0	0	563
Sept	207	298	0	0	506
Oct	209	295	0	0	504
Nov	189	295	0	0	484
Dec	186	295	0	0	481
Tot.	2,464	3,622	0	0	6,087

\*\*\*\*\*  
TABLE 2. MONTHLY TOTALS  
\*\*\*\*\*

Month	Charges (\$)	Energy (kWh)	Effective Rate (\$/kWh)
Jan	484	9,092	0.05319
Feb	466	8,246	0.05653
Mar	491	9,452	0.05196
Apr	492	9,516	0.05175
May	511	10,419	0.04906
June	537	10,817	0.04963
July	567	11,550	0.04913
Aug	563	11,674	0.04822
Sept	506	10,006	0.05054
Oct	504	10,085	0.05000
Nov	484	9,110	0.05313
Dec	481	8,974	0.05362
Tot.	6,087	118,941	0.05118

1359-135

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Control Tower  
Building 1359  
Fort Belvoir, VA

By: Engineering Applications Consultants

ECO: Replace single glaze windows with double glaze windows

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install windows (3x4)	10	each	\$38	\$380	\$250	\$2,500	\$2,880
Install windows (3x3)	2	each	\$27	\$54	\$220	\$440	\$494
Remove windows	12	each	\$29	\$348	---	---	
SUB-TOTAL:				\$782		\$2,940	\$3,374
labor Markup: 21%				\$164		---	\$164
Taxes: 4.5%				---		\$132	\$132
SUB-TOTAL:				\$946		\$3,072	\$3,671
Overhead: 10%				\$95		\$307	\$402
SUB-TOTAL:				\$1,041		\$3,380	\$4,072
Profit: 10%				\$104		\$338	\$442
TOTAL:				\$1,145		\$3,717	\$4,514

## ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Double Glazed Window  
 Prepared By : E A C, PC BURKE, VA.  
 320-II Advanced Economic Analysis Program  
 LCCID - based (version 1, level 35).

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## STUDY IDENTIFICATION BLOCK

Project Title : ESOS  
 Installation Name : FORT BELVOIR, BLDG 1359  
 Project Number : DACA-31-89-C-0198  
 Fiscal Year : 1991  
 Name of Analyst : EAC

## KEY STUDY DATES

ECIP Economic Life : 25 (years)

## INVESTMENT COST SUMMARY

Construction cost	\$	4862
SIOH costs	\$	267
Design costs	\$	292
Energy credit calc	\$	4879
Salvage value cost	-\$	0
Total investment cost	\$	4879

## ANNUAL ENERGY SAVINGS(+) / COST(-), DOE REGION 3 , CENSUS REGION 3

Fuel	Unit Cost \$/MBTU	Savings MBTU / Yr	Annual Savings \$	Discount Factor	Discounted Savings
ELEC	6.07	0	0	11.37	0
DIST	0.00	0	0	17.06	0
RESID	9.97	4	44	16.85	739
NAT G	0.00	0	0	17.52	0
COAL	0.00	0	0	13.34	0
TOTAL		4	44		\$ 739

## NON-ENERGY ANNUAL SAVINGS(+) / COST(-)

Item	Annual Savings \$	Discount Factor	Discounted Savings
Maintenance	6	11.65	70
Total discounted savings(+) / costs(-)			\$ 70

# ENERGY CONSERVATION INVESTMENT PROGRAM REPORT

Discrete Portion : Double Glazed Window

09-26-91

Prepared By : E A C, PC BURKE, VA.

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## NON-ENERGY ONE-TIME SAVINGS(+) / COST(-)

Item	One-Time Savings \$	Year	Discount Factor	Discounted Savings
------	------------------------	------	--------------------	-----------------------

No cost items.

Total discounted savings(+) / costs(-)	\$	0
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\*\*\*\*\*

## DISCOUNTED NON-ENERGY SAVINGS(+) / COST(+) TOTALS

Non-energy annual savings	\$	70
---------------------------	----	----

Non-energy one-time savings	\$	0
-----------------------------	----	---

Total non-energy savings	\$	70
--------------------------	----	----

\*\*\*\*\*

## PROJECT QUALIFICATION TESTS

Project non-energy qualification test.

Energy savings calc	\$	244
---------------------	----	-----

Non-energy qualification not applicable.

First year Dollar savings	\$	50
---------------------------	----	----

Total net discounted savings	\$	809
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Discounted savings ratio		0.17
--------------------------	--	------

(SIR < 1) Project does not qualify.

Simple payback period (years)		97.84
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\*\*\*\*\*

FORT BELVOIR BUILDING 1359

	COST	SIOH	DESIGN	ENERGY	SAVINGS			NON-ENERGY		DOLLAR SAVINGS	
				ELEC MBTU	OIL MBTU	ANNUAL \$	DISCNTD \$	ANNUAL \$	DISCNTD \$	1st YEAR	DISCOUNTED
RADIATOR CONTROL VALVES	896	49	54	0	25	244	2943	0	0	244	2943
CLG. INSUL	502	28	30	2	7	77	1240	31	361	108	1601
WEATHER- STRIPPING	685	38	0	0	21	212	922	51	209	263	1131
NIGHT- SETBACK	1126	62	68	13	7	150	1554	0	0	150	1554
REFLECTORS	728	40	0	6	-2	18	95	93	847	111	943
TOTALS	3937	217	151	21	58	701	6754	175	1417	876	8172



LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT BELVOIR REGION NO. 3 PROJECT NUMBER DACA-31-89-C-0198

PROJECT TITLE: ENERGY SAVINGS OPPORTUNITY SURVEY FISCAL YR. 1991

DISCRETE PORTION NAME BUILDING 1359 - TOTAL ALL ECO's

ANALYSIS DATE AUGUST 1991 ECONOMIC LIFE \_\_\_\_\_ YEARS PREPARED BY EAC

1. INVESTMENT

A. CONSTRUCTION COST	\$ <u>3,937</u>	
B. SIOH	\$ <u>217</u>	
C. DESIGN COST	\$ <u>151</u>	
D. SALVAGE VALUE	- \$ _____	
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)		\$ <u>4,305</u>

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

	<u>FUEL</u>	<u>COST</u> <u>\$/MBTU/YR(1)</u>	<u>SAVINGS</u> <u>MBTU/YR(2)</u>	<u>ANNUAL \$</u> <u>SAVINGS (3)</u>	<u>DISCOUNT</u> <u>FACTOR (4)</u>	<u>DISCOUNTED</u> <u>SAVINGS (5)</u>
A. ELEC	\$ <u>6.07</u>	<u>21</u>	\$ _____	_____	\$ _____	
B. DIST	\$ <u>7.43</u>	_____	\$ _____	_____	\$ _____	
C. RESID	\$ <u>9.97</u>	<u>58</u>	\$ _____	_____	\$ _____	
D. NG	\$ <u>5.33</u>	_____	\$ _____	_____	\$ _____	
E. COAL	\$ _____	_____	\$ _____	_____	\$ _____	
F. TOTAL		<u>79</u>	\$ <u>701</u>		\$ <u>6,754</u>	

3. NONENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	\$ <u>175</u>
(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$ <u>1,417</u>

B. NONRECURRING SAVINGS (+) / COST (-)

<u>ITEM</u>	<u>SAVINGS (+)</u> <u>COST (-)(1)</u>	<u>YEAR OF</u> <u>OCCUR.(2)</u>	<u>DISCOUNT</u> <u>FACTOR(3)</u>	<u>DISCOUNTED SAV-</u> <u>INGS(+) COST(-)(4)</u>
(1) _____	\$ _____	_____	_____	\$ _____
(2) _____	\$ _____	_____	_____	\$ _____
(3) _____	\$ _____	_____	_____	\$ _____
(4) TOTAL	\$ _____			\$ _____

C. TOTAL NONENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ \_\_\_\_\_

D. PROJECT NONENERGY QUALIFICATION TEST

(1) 25% MAX NONENERGY CALC (2F5 x .33) \$ \_\_\_\_\_

a. IF 3D1 IS = OR > 3C GO TO ITEM 4

b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) - 1E = \_\_\_\_\_

c. IF 3D1 IS = > 1 GO TO ITEM 4

d. IF 3D1 IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3 + 3A + (3B1d - YEARS ECONOMIC LIFE) \$ 876

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 8,171

6. DISCOUNTED SAVINGS RATION (IF < 1 PROJECT DOES NOT QUALIFY) (S1R) = (5-1E) = 1.9

1359-140

BUILDINGS 1 TO 60  
GENERAL OFFICERS' QUARTERS  
(TYPICALS)

QUARTERS 1 THROUGH 60

**Fuel Conversion:**

Description - Existing oil-fired boilers used for heating and oil-fired water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= 1,607	MBTU/year
Cost	= \$ 520,753	(incl. SIOH)
SIR	= 1.3	

# QUARTERS 1 THROUGH 60

Bldg No.	Location	Complex Code	Bed- rooms	Sq Ft	Year
1	Fairfax Drive	OX	5	7,262 ✓	35
2	Fairfax Drive	OX	5	4,803 ✓	34
3	Fairfax Drive	OX	5	3,461 ✓	34
4	Fairfax Drive	OX	5	4,803	34
5	Fairfax Drive	3X	4/SP	3,575 ✓	35
6	Fairfax Drive	3X	4	3,295 ✓	34
7	Woodlawn Drive	3X	4	3,575	35
8	Woodlawn Drive	3X	4	3,575	35
9	Woodlawn Drive	3X	4	3,295	34
10	Woodlawn Drive	3X	4	3,575	35
11	Woodlawn Drive	3X	4	3,295	34
12	Woodlawn Drive	3X	4/SP	3,473 ✓	35
13	Woodlawn Drive	OX	5	4,803	34
14	Woodlawn Drive	3X	5	4,803	34
15	Woodlawn Drive	3X	5	4,803	34
16	Woodlawn Drive	OX	5	4,803	34
17	Woodlawn Drive	3X	5	4,803	34
18	Woodlawn Drive	3X	5	4,803 -	34
19	Woodlawn Drive	3X	5	3,461 -	34
21	Mason Drive	3X	4/SP	3,473	35
22	Mason Drive	3X	4	3,257 ✓	34
23	Mason Drive	3X	4/SP	3,473	35
24	Mason Drive	3X	4/SP	3,473	34
25	Mason Drive	3X	4	3,257	34
26	Mason Drive	3X	4	3,257	34
27	Mason Drive	3X	4/SP	3,575	35
28	Mason Drive	3X	4/SP	3,575	35
29	Mason Drive	3X	4	3,295	34
30	Mason Drive	3X	4	3,575	35
31	Mason Drive	3X	4	3,295	34
32	Mason Drive	3X	4/SP	3,575	35
33	Mason Drive	3X	4	3,295	34
34	Belvoir Drive	3X	4	3,295	34
35	Belvoir Drive	3X	4	3,575	35
36	Belvoir Drive	3X	4	3,295	34
37	Belvoir Drive	3X	4	3,575	35
38	Belvoir Drive	3X	4	3,575	35
39	Belvoir Drive	3X	4	3,295	34
40	Belvoir Drive	3X	4	3,295	34
41	Belvoir Drive	3X	4	3,575	35
42	Belvoir Drive	3X	4	3,575	34
43	Belvoir Drive	3X	4/SP	3,575	35
44	Belvoir Drive	3X	4/SP	3,575	35
45	Belvoir Drive	3X	4	3,295	34
46	Belvoir Drive	3X	4/SP	3,575	35
47	Belvoir Drive	3X	4	3,295	34

Bldg No.	Location	Complex Code	Bed- rooms	Sq Ft	Year
48	Belvoir Drive	3X	4/SP	3,575	35
49	Belvoir Drive	3X	4	3,295	34
50	Belvoir Drive	3X	4/SP	3,575	35
51	Belvoir Drive	3X	4	3,295	34
52	Fairfax Drive	3X	5	4,803	34
53	Fairfax Drive	OX	5	4,803	34
54	Fairfax Drive	OX	5	4,803	34
55	Fairfax Drive	OX	5	4,803	34
56	Fairfax Drive	3X	5	4,803	34
57	Fairfax Drive	3X	5	4,803	34
58	Fairfax Drive	OX	5	4,803	34
59	Fairfax Drive	OX	5	4,803	34
60	Fairfax Drive	OX	5	4,803	34

QUARTERS 1-60

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## DESIGN PARAMETERS, SHGs

Location : FT. BELVOIR, VIRGINIA

04-27-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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## DESIGN WEATHER PARAMETERS

City Name.....: FT. BELVOIR  
 Location.....: VIRGINIA  
 Latitude.....: 38.4 deg  
 Elevation.....: 69.0 ft  
 Summer Design Dry Bulb Temp.....: 90.0 F  
 Summer Design Wet Bulb Temp.....: 75.0 F  
 Daily Temperature Range.....: 23.0 F  
 Winter Design Dry Bulb Temp.....: 12.0 F  
 Atmospheric Clearness Number.....: 1.00

TABLE 1. MAXIMUM SOLAR HEAT GAINS - AVERAGE DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	24.2	61.1	97.3	110.1	97.3	61.1	24.2	24.2	80.0
Feb	31.8	74.8	105.7	113.8	105.7	74.8	31.8	31.8	107.2
Mar	40.8	87.0	106.9	108.0	106.9	87.0	40.8	40.8	136.8
Apr	60.0	97.4	104.4	97.2	104.4	97.4	60.0	49.3	164.3
May	74.9	103.0	98.4	84.0	98.4	103.0	74.9	54.9	181.8
Jun	85.1	109.3	97.5	79.2	97.5	109.3	85.1	57.9	195.2
Jul	80.6	106.7	98.1	81.4	98.1	106.7	80.6	56.4	189.3
Aug	69.1	104.1	105.7	94.4	105.7	104.1	69.1	52.2	177.6
Sep	52.3	99.3	114.8	111.6	114.8	99.3	52.3	45.4	158.1
Oct	36.4	88.3	117.7	122.9	117.7	88.3	36.4	36.4	128.2
Nov	26.7	66.5	101.8	113.3	101.8	66.5	26.7	26.7	89.4
Dec	21.4	53.0	87.6	100.9	87.6	53.0	21.4	21.4	68.4

TABLE 2. MAXIMUM SOLAR HEAT GAINS - DESIGN DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	20.4	158.9	243.9	253.8	243.9	158.9	20.4	20.4	142.0
Feb	53.0	189.1	246.5	237.5	246.5	189.1	53.0	24.7	187.7
Mar	95.9	219.8	234.5	200.7	234.5	219.8	95.9	29.4	229.0
Apr	141.6	224.4	200.1	146.7	200.1	224.4	141.6	34.1	256.0
May	166.1	220.1	170.7	104.6	170.7	220.1	166.1	37.4	268.0
Jun	173.2	215.4	156.7	87.8	156.7	215.4	173.2	47.4	269.7
Jul	163.7	215.7	166.5	101.4	166.5	215.7	163.7	38.3	264.7
Aug	136.4	216.6	193.1	141.7	193.1	216.6	136.4	35.8	251.3
Sep	90.3	207.2	224.7	194.9	224.7	207.2	90.3	30.6	221.4
Oct	52.0	182.7	238.2	230.6	238.2	182.7	52.0	25.5	184.4
Nov	20.7	156.1	239.8	249.9	239.8	156.1	20.7	20.7	141.3
Dec	18.5	141.9	236.4	254.2	236.4	141.9	18.5	18.5	122.2

MASTER SCHEDULE SUMMARY

Page 1

Prepared By : E A C

04-14-91

Carrier Hourly Analysis Program

6100190202

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MASTER SCHEDULE 1. OCCUPANCY

Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	100	100	100	100	100	100	100	50	30	30	30	30
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	50	30	30	30	30	50	70	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*

MASTER SCHEDULE 2. HOT WATER

Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	0	0	0	0	0	100	100	100	80	60	30	10
Saturday	0	0	0	0	0	0	100	100	100	100	70	70
Sunday	0	0	0	0	0	0	100	100	100	100	70	70
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	10	10	10	10	10	30	30	30	30	60	40	20
Saturday	10	10	10	10	10	10	10	30	30	30	30	10
Sunday	10	10	10	10	10	10	10	30	30	30	30	10
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*

MASTER SCHEDULE 3. EMPTY

Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	100	100	100	100	100	100	100	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*



## SIMPLE SPACE DESCRIPTION

Space Name : OFFICERS' QUARTERS TYP A

04-14-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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	Walls	Roof	Glass		
U-Value :	0.300	0.200	0.500	Building Weight :	M
Weight :	M	M		Glass Factor :	0.80
Color :	M	M		Internal Shades ?	N

People : sqft/person = 533.0 Schedule = 1 Activity Level = 1  
Lights : W/sqft = 0.00 Schedule = 1 Wattage Mult. = 1.00  
: Fixture Type = 1 Recessed, not vented

-----  
SPACE NAME = OFFICERS' QUARTERS TYP A

			Floor Area :	4,803.0 sqft
Exposure :	NE	E	Roof Area :	1,648.0 sqft
Wall Area :	4,631.0	0.0	Current	
Glass Area :	367.0	0.0	Elements :	In,Gr,Gl

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling : 0.00 CFM/sqft = 0 CFM  
Heating : 0.10 CFM/sqft = 480 CFM  
Typical : 0.10 CFM/sqft = 480 CFM

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area = 1,120.0 sqft  
Perimeter = 136.0 ft  
Depth = 4.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value = 0.640 BTU/hr/sqft/F Exposure = S  
Glass Factor = 0.52 Area = 98.0 sqft  
Internal Shades ? N

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : OFFICERS' QUARTERS TYP B

04-14-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.300	0.200	0.500	Building Weight :	M
Weight :	M	M		Glass Factor :	0.80
Color :	M	M		Internal Shades ?	N

People : sqft/person = 533.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 1    Wattage Mult. = 1.00  
 : Fixture Type = 1 Recessed, not vented

SPACE NAME = OFFICERS' QUARTERS TYP B

Exposure :	NE	E	Floor Area :	3,295.0 sqft
Wall Area :	3,730.0	0.0	Roof Area :	1,340.0 sqft
Glass Area :	304.0	0.0	Current	
			Elements :	In,Gr,Gl

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling :	0.00 CFM/sqft =	0 CFM
Heating :	0.10 CFM/sqft =	340 CFM
Typical :	0.10 CFM/sqft =	340 CFM

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	1,080.0 sqft
Perimeter	=	136.0 ft
Depth	=	4.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value	=	0.640 BTU/hr/sqft/F	Exposure	=	S
Glass Factor	=	0.52	Area	=	90.0 sqft
Internal Shades	?	N			

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : OFFICERS' QUARTERS TYP C

04-14-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.300	0.200	0.500	Building Weight :	M
Weight :	M	M		Glass Factor :	0.80
Color :	M	M		Internal Shades ?	N

People : sqft/person = 533.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 1 Wattage Mult. = 1.00  
 : Fixture Type = 1 Recessed, not vented

SPACE NAME = OFFICERS' QUARTERS TYP C

		Floor Area :	3,575.0 sqft
Exposure :	NE	E Roof Area :	1,100.0 sqft
Wall Area :	3,603.0	0.0 Current	
Glass Area :	410.0	0.0 Elements :	In,Gr,Gl

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling :	0.00 CFM/sqft =	0 CFM
Heating :	0.13 CFM/sqft =	455 CFM
Typical :	0.13 CFM/sqft =	455 CFM

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	1,100.0 sqft
Perimeter	=	136.0 ft
Depth	=	4.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value	=	0.640 BTU/hr/sqft/F	Exposure =	S
Glass Factor	=	0.52	Area =	171.0 sqft
Internal Shades	?	N		

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER #1

04-28-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = QUARTER #1  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	100.0 F	68.0 F	CLOSED
Unoccupied	100.0 F	68.0 F	CLOSED

Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
 Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
 Heating supply temperature = 110.0 F  
 Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 20.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER #1

04-28-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 12:User defined  
kW at full air flow = 0.0 kW  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050

Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE A

04-28-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = QUARTER TYPE A  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	100.0 F	68.0 F	CLOSED
Unoccupied	100.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
 Heating supply temperature = 110.0 F  
 Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 20.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE A  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-28-91  
6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 12:User defined  
kW at full air flow = 0.0 kW  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE B

04-28-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = QUARTER TYPE B  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	100.0 F	68.0 F	CLOSED
Unoccupied	100.0 F	68.0 F	CLOSED
-----			
Weekday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Saturday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Sunday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Design Day	: Occupied Period Begins at	0 ; Duration	= 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
Heating supply temperature = 110.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 20.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*



# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE B  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-28-91  
6100190202  
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\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 12:User defined  
kW at full air flow = 0.0 kW  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE C

04-28-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C

Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = QUARTER TYPE C  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	100.0 F	68.0 F	CLOSED
Unoccupied	100.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
 Heating supply temperature = 110.0 F  
 Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 20.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : QUARTER TYPE C  
Carrier Hourly Analysis Program  
Prepared By : E A C

04-28-91  
6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 12:User defined  
kW at full air flow = 0.0 kW  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*



# FUEL RATE DATA

Fuel Rate : NATURAL GAS

04-28-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. FUEL RATE DATA

### NAME

Name of rate schedule = NATURAL GAS

### CURRENCY

Currency name = Dollars

Currency symbol = \$

### BASIC INFORMATION

Units of measurement = Therms

Conversion factor = 100.00000 kBTU/Therms

Type of rate schedule = 1 Simple

Flat rate charge = 0.53290 \$/Therms

\*\*\*\*\*

# FUEL RATE DATA

Fuel Rate : FUEL OIL #2

04-28-91

Prepared By : E A C

6100190202

Barrier Hourly Analysis Program

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\*\*\*\*\*

## 1. FUEL RATE DATA

### NAME

Name of rate schedule = FUEL OIL #2

### CURRENCY

Currency name = Dollars

Currency symbol = \$

### BASIC INFORMATION

Units of measurement = gal

Conversion factor = 138.70000 kBTU/gal

Type of rate schedule = 1 Simple

Flat rate charge = 1.03000 \$/gal

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER #1 (OIL)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER #1 (OIL)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW  
Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y  
Maximum hourly hot water use = 6.0 gal  
Hot water schedule = 1  
Average entering water temperature = 57.0 F  
Average hot water supply temperature = 140.0 F  
Heating plant type = 2 : Combustion  
Fuel type = 2 : Fuel Oil  
Plant capacity = 60.0 MBH  
Is plant efficiency computer generated ? N  
Annual plant efficiency = 70 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft  
Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER #1 (OIL)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER TYPE A (OIL)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE A (OIL)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 2 : Fuel Oil

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 70 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE A (OIL)	1		

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$



# BUILDING DESCRIPTION

Building : QUARTER TYPE B (OIL)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE B (OIL)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 2 : Fuel Oil

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 70 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE B (OIL)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER TYPE C (OIL)

04-28-91

Prepared By: E A C

6100190202

Barrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE C (OIL)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 2 : Fuel Oil

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 70 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE C (OIL)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER #1 (GAS)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER #1 (GAS)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 1 : Natural Gas

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 78 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER #1 (GAS)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER TYPE A (GAS)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE A (GAS)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW  
Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y  
Maximum hourly hot water use = 6.0 gal  
Hot water schedule = 1  
Average entering water temperature = 57.0 F  
Average hot water supply temperature = 140.0 F  
Heating plant type = 2 : Combustion  
Fuel type = 1 : Natural Gas  
Plant capacity = 60.0 MBH  
Is plant efficiency computer generated ? N  
Annual plant efficiency = 78 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft  
Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE A (GAS)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER TYPE B (GAS)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE B (GAS)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 1 : Natural Gas

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 78 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE B (GAS)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : QUARTER TYPE C (GAS)

04-28-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = QUARTER TYPE C (GAS)

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 6.0 gal

Hot water schedule = 1

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 1 : Natural Gas

Plant capacity = 60.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 78 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
QUARTER TYPE C (GAS)	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	3	Virginia Power Schedule MS	\$
Natural Gas	1	NATURAL GAS	\$
Fuel Oil	5	FUEL OIL #2	\$
Propane	5	FUEL OIL #2	\$
Remote Source Heating	5	FUEL OIL #2	\$
Remote Source Cooling	5	FUEL OIL #2	\$

\*\*\*\*\*

## ENERGY BUDGET &lt;A&gt;

Building : QUARTER #1 (OIL)  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-28-91  
 6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*  
TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	249,768	34.394

\*\*\*\*\*  
TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	356,811	49.134	356,811	49.134
Pumps	1,839	0.253	1,839	0.253
>> HVAC Total	358,649	49.387	358,649	49.387
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	41,570	5.724	41,570	5.724
>> Non-HVAC Total	41,570	5.724	41,570	5.724
>> GRAND TOTAL	400,219	55.111	400,219	55.111

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 7,262 sqft  
     Conditioned floor area = 7,262 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

## ENERGY BUDGET &lt;A&gt;

Building : QUARTER TYPE A (OIL)

04-28-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	177,479	36.952

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	253,542	52.788	253,542	52.788
Pumps	0	0.000	0	0.000
>> HVAC Total	253,542	52.788	253,542	52.788
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	41,570	8.655	41,570	8.655
>> Non-HVAC Total	41,570	8.655	41,570	8.655
>> GRAND TOTAL	295,111	61.443	295,111	61.443

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 4,803 sqft  
     Conditioned floor area = 4,803 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*



# ENERGY BUDGET <A>

Building : QUARTER TYPE B (OIL)

04-28-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	138,626	42.072

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	198,037	60.102	198,037	60.102
Pumps	0	0.000	0	0.000
>> HVAC Total	198,037	60.102	198,037	60.102
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	41,570	12.616	41,570	12.616
>> Non-HVAC Total	41,570	12.616	41,570	12.616
>> GRAND TOTAL	239,607	72.718	239,607	72.718

- \* Notes: 1. Site energy is the actual energy consumed.  
2. Source energy accounts for electrical generating inefficiencies. For this study:  
Electric generating efficiency =100.0 %  
3. Energy per unit floor area is based on the gross building floor area. For this building:  
Gross floor area = 3,295 sqft  
Conditioned floor area = 3,295 sqft  
4. Annual cooling load is the sum of all cooling plant loads.  
5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

ENERGY BUDGET <A>

Building : QUARTER TYPE C (OIL)  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-28-91  
 6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	148,636	41.576

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	212,337	59.395	212,337	59.395
Pumps	0	0.000	0	0.000
>> HVAC Total	212,337	59.395	212,337	59.395
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	41,570	11.628	41,570	11.628
>> Non-HVAC Total	41,570	11.628	41,570	11.628
>> GRAND TOTAL	253,907	71.023	253,907	71.023

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 3,575 sqft  
     Conditioned floor area = 3,575 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

## ENERGY BUDGET &lt;A&gt;

Building : QUARTER #1 (GAS)  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-28-91  
 6100190202

Carrier Hourly Analysis Program

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	249,768	34.394

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	320,215	44.095	320,215	44.095
Pumps	1,839	0.253	1,839	0.253
>> HVAC Total	322,053	44.348	322,053	44.348
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	37,306	5.137	37,306	5.137
>> Non-HVAC Total	37,306	5.137	37,306	5.137
>> GRAND TOTAL	359,359	49.485	359,359	49.485

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency = 100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 7,262 sqft  
     Conditioned floor area = 7,262 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

ENERGY BUDGET <A>

Building : QUARTER TYPE A (GAS)  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-28-91  
 6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	177,479	36.952

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	227,538	47.374	227,538	47.374
Pumps	0	0.000	0	0.000
>> HVAC Total	227,538	47.374	227,538	47.374
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	37,306	7.767	37,306	7.767
>> Non-HVAC Total	37,306	7.767	37,306	7.767
>> GRAND TOTAL	264,844	55.141	264,844	55.141

- \* Notes:
1. Site energy is the actual energy consumed.
  2. Source energy accounts for electrical generating inefficiencies. For this study:  
 Electric generating efficiency = 100.0 %
  3. Energy per unit floor area is based on the gross building floor area. For this building:  
 Gross floor area = 4,803 sqft  
 Conditioned floor area = 4,803 sqft
  4. Annual cooling load is the sum of all cooling plant loads.
  5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

## ENERGY BUDGET &lt;A&gt;

Building : QUARTER TYPE B (GAS)

04-28-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	138,626	42.072

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	177,726	53.938	177,726	53.938
Pumps	0	0.000	0	0.000
>> HVAC Total	177,726	53.938	177,726	53.938
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	37,306	11.322	37,306	11.322
>> Non-HVAC Total	37,306	11.322	37,306	11.322
>> GRAND TOTAL	215,032	65.260	215,032	65.260

- \* Notes: 1. Site energy is the actual energy consumed.  
 2. Source energy accounts for electrical generating inefficiencies. For this study:  
     Electric generating efficiency =100.0 %  
 3. Energy per unit floor area is based on the gross building floor area. For this building:  
     Gross floor area = 3,295 sqft  
     Conditioned floor area = 3,295 sqft  
 4. Annual cooling load is the sum of all cooling plant loads.  
 5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

## ENERGY BUDGET &lt;A&gt;

Building : QUARTER TYPE C (GAS)

04-28-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. ANNUAL LOADS

Component	(kBTU)	(kBTU/sqft)*
Cooling Loads *	0	0.000
Heating Loads *	148,636	41.576

\*\*\*\*\*

TABLE 2. ENERGY BY SYSTEM COMPONENT

Component	<----- Site Energy ----->		<----- Source Energy ----->	
	(kBTU)	(kBTU/sqft)*	(kBTU)	(kBTU/sqft)*
Air System Fans	0	0.000	0	0.000
Cooling Plants	0	0.000	0	0.000
Heating Plants	190,559	53.303	190,559	53.303
Pumps	0	0.000	0	0.000
>> HVAC Total	190,559	53.303	190,559	53.303
Lights	0	0.000	0	0.000
Other Electric	0	0.000	0	0.000
Misc. Electric	0	0.000	0	0.000
Dom. Hot Water	37,306	10.435	37,306	10.435
>> Non-HVAC Total	37,306	10.435	37,306	10.435
>> GRAND TOTAL	227,865	63.738	227,865	63.738

\* Notes: 1. Site energy is the actual energy consumed.

2. Source energy accounts for electrical generating inefficiencies. For this study:

Electric generating efficiency =100.0 %

3. Energy per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 3,575 sqft

Conditioned floor area = 3,575 sqft

4. Annual cooling load is the sum of all cooling plant loads.

5. Annual heating load is the sum of all primary and auxiliary heating plant loads. It does not include the domestic water heating load.

\*\*\*\*\*

QUARTERS 1 THROUGH 60

**Fuel Conversion:**

Description - Existing oil-fired boilers used for heating and oil-fired water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= 1,607	MBTU/year
Cost	= \$ 520,753	(incl. SIOH)
SIR	= 1.3	

PORT BELVOIR OFFICERS QUARTERS

CONSTRUCTION COSTS AND ENERGY SAVINGS CONSOLIDATION

TYPE	No.	ENERGY SAVINGS, MBTU/BLDG			TOTAL ENERGY SAVINGS, MBTU		
		ELEC.	OIL	GAS	ELEC.	OIL	GAS
I	1	0	398	-357	0	398	-357
A	19	0	295	-265	0	5605	-5035
B	18	0	240	-215	0	4320	-3870
C	21	0	254	-228	0	5334	-4788
TOTAL	59				0	15657	-14050



<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED <b>APR. 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>							
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>							
DRAWING NO. <b>1-60 QUARTERS</b>		ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<b>TYPE 1</b> SUMMARY <b>CONVERSION TO GAS</b>		QUANTITY		LABOR		MATERIAL	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL
<b>DEMOLITION</b>							
REMOVE 275 GAL OIL TANK							
CLEANING, & DISPOSAL	2	EA	420	840		-	840
REMOVE OIL BOILER	1	EA		320			320
PATCH PIPE OPENING	1	EA		50		20	70
						-	
<b>NEW WORK</b>							
GAS BOILER w/CONTROLS	1	EA		850		2050	2900
PRES. REG., VALVES, ETC.		LS		85		160	245
GAS PIPING	40	LF	4.00	160	1.84	74	234
HAND EXCAVATING	2.5	CY	34.	85		-	85
HOLE THRU BSMT. WALL	1	EA		54		-	54
BACKFILLING, HAND	2.5	CY	12.45	32		-	32
MISC & GENERAL CLEANUP		LS		125		51	176
FLUES TO CHIMNEY 4"	12	LF	5.15	62	2.86	35	97
6"	12	LF	2.00	70	3.96	48	115
<b>SUB-TOTAL</b>				2733		2438	5171
LABOR INS & TAXES 21%				574			574
SALES TAX 4.5%						110	110
<b>SUB-TOTAL</b>							5855
OVERHEAD 10%							586
<b>SUB-TOTAL</b>							6441
PROFIT 10%							644
<b>SUB-TOTAL</b>							7085
<b>TOTAL</b>							<b>\$7085</b>

<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED <b>APR. 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE D (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____		
LOCATION <b>FT. BELVOIR, VIRGINIA</b>							
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>							
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>		
TYPE A,B & C CONVERSION TO GAS		QUANTITY		LABOR		MATERIAL	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL
<b>SUMMARY</b>							
<b>DEMOLITION</b>							
REMOVE 275 GAL OIL TANK,							
CLEANING & DISPOSAL							
	1	EA		420			420
REMOVE OIL BOILER							
	1	EA		320			320
PATCH FIRE OPENING							
	1	EA		50		20	70
<b>NEW WORK</b>							
GAS BOILER W/CONTROLS							
	1	EA		840		1600	2440
PRES. REG., VALVES ETC							
	1	LS		85		160	245
GAS PIPING							
	30	LF	4.00	120	1.84	55	175
HAND EXCAVATING							
	2.5	CY	34.	85			85
HOLE THRU BSMT WALL							
	1	EA		54			54
BACKFILLING, HAND							
		LS		125		51	176
FLUES TO CHIMNEY 4"							
	12	LF	5.15	62	2.86	35	97
6"							
	10	LF	5.85	59	3.96	40	99
MISC & GENERAL CLEANUP							
		LS		125		51	176
<b>SUB-TOTAL</b>				<b>2345</b>		<b>2012</b>	<b>4357</b>
LABOR INS & TAXES 21%				<b>492</b>			<b>492</b>
SALES TAX 4.5%						<b>91</b>	<b>91</b>
<b>SUB-TOTAL</b>							<b>4940</b>
OVERHEAD 10%							<b>494</b>
<b>SUB-TOTAL</b>							<b>5434</b>
PROFIT 10%							<b>543</b>
<b>SUB-TOTAL</b>							<b>5977</b>
<b>TOTAL</b>							<b>\$ 5977</b>

## CONSTRUCTION COST ESTIMATE

DATE PREPARED APR 1991

SHEET OF

## PROJECT

ENERGY SAVINGS OPPORTUNITY SURVEY

## LOCATION

FT. BELVOIR, VIRGINIA

## ARCHITECT ENGINEER

ENGINEERING APPLICATIONS CONSULTANTS

## BASIS FOR ESTIMATE

- ☐ CODE A (No design completed)  
☐ CODE B (Preliminary design)  
☐ CODE C (Final design)  
☐ OTHER (Specify) \_\_\_\_\_

## DRAWING NO.

1-60 QUARTERS

## ESTIMATOR

REF

## CHECKED BY

VP

TYPE ALL SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
REPLACE GAS HOT WATER HEATER W/SAME							
REMOVE HOT WATER HEATER				50			50
GAS HOT WATER HEATER INCLUDING PIPING AND FITTINGS WITHIN 10' OF SAME	1	EA		680		470	1150
SUB-TOTAL				730		470	1200
LABOR INS & TAXES 21%				153			153
SALES TAX 4.5%						21	21
SUB-TOTAL							1374
OVERHEAD 10%							137
SUB-TOTAL							1511
PROFIT 10%							151
SUB-TOTAL							1662
TOTAL							\$1665.

<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>APR 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE D (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>1-600 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<b>TYPE 1</b> SUMMARY <b>REPLACE OIL BOILERS &amp; HW HEATERS WITH SAME</b>		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
REMOVE BOILER		1	EA		320			320
CHANGE OIL TANK FILTERS		2	EA	10	20	10	20	40
OIL BOILER W/CONTROLS		1	EA		916		2070	2986
OIL CONNECTIONS		2	EA	10	20	10	20	40
FLUE TO CHIMNEY 6"		12	LF	5.85	70	3.96	48	118
MISC. & GENERAL CLEANUP			LS		125		50	175
SUB-TOTAL					1174		2208	3382.
LABOR INS & TAXES 21%					247			247.
SALES TAX 4.5%							100	100.
SUB-TOTAL								3729.
OVERHEAD 10%								373.
SUB-TOTAL								4102.
PROFIT 10%								410.
SUB-TOTAL								4,512.
TOTAL								\$4,515.

<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED <b>APR 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE D (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>							
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>							
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>		
TYPE A,B,&C SUMMARY <b>REPLACE OIL BOILERS &amp; H/W HEATERS WITH SAME</b>		QUANTITY		LABOR		MATERIAL	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL
REMOVE BOILER		1	EA		320		320
							50
CHANGE OIL TANK FILTER		1	EA		10	10	20
OIL BOILER w/CONTROLS		1	EA		755	1670	2425
OIL CONNECTIONS		1	EA		10	10	20
FLUE TO CHIMNEY 6"		10	LF		59	40	99
MISC & GENERAL CLEANUP			LS		125	50	175
SUB-TOTAL					1279	1780	3059
LABOR, INS & TAXES 21%					269		269
SALES TAX 4.5%						80	80
SUB-TOTAL							3408
OVERHEAD 10%							341
SUB-TOTAL							3749
PROFIT 10%							375
SUB-TOTAL							4,124.
TOTAL							\$4,125.

CONSTRUCTION COST ESTIMATE					DATE PREPARED <b>APR 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<b>ALL TYPES</b> SUMMARY REPLACE OIL HOT WATER HEATER W/SAVE		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
REMOVE HW HEATER		1	EA		50			50
OIL HW HEATER 50 GAL		1	EA		640		1200	1840
INCLUDING PIPING & FITTINGS								
WITHIN 10' OF HEATER &								
FLUE CONNECTION								
SUB-TOTAL					690		1200	1890
LABOR, INS, & TAXES 21%					145			145
SALES TAX 4.5%							54	54
SUB-TOTAL								2089
OVERHEAD 10%								209
SUB-TOTAL								2298
PROFIT 10%								230
SUB-TOTAL								2528
TOTAL								\$ 2590.

<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>APR. 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VF</b>			
<b>TYPE 1</b> SUMMARY <b>CONVERSION TO GAS</b>		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
<b>DEMOLITION</b>								
<b>REMOVE 275 GAL OIL TANK,</b>								
<b>CLEANING, &amp; DISPOSAL</b>		<b>2</b>	<b>EA</b>	<b>420</b>	<b>840</b>		<b>-</b>	<b>840</b>
<b>REMOVE OIL BOILER</b>		<b>1</b>	<b>EA</b>		<b>320</b>			<b>320</b>
<b>PATCH PIPE OPENING</b>		<b>1</b>	<b>EA</b>		<b>50</b>		<b>20</b>	<b>70</b>
							<b>-</b>	
<b>NEW WORK</b>								
<b>GAS BOILER w/controls</b>		<b>1</b>	<b>EA</b>		<b>850</b>		<b>2050</b>	<b>2900</b>
<b>PRES. REG., VALVES, ETC.</b>			<b>LS</b>		<b>85</b>		<b>160</b>	<b>245</b>
<b>GAS PIPING</b>		<b>40</b>	<b>LF</b>	<b>4.00</b>	<b>160</b>	<b>1.84</b>	<b>74</b>	<b>234</b>
<b>HAND EXCAVATING</b>		<b>2.5</b>	<b>CY</b>	<b>34.</b>	<b>85</b>		<b>-</b>	<b>85</b>
<b>HOLE THRU BSMT. WALL</b>		<b>1</b>	<b>EA.</b>		<b>54</b>		<b>-</b>	<b>54</b>
<b>BACKFILLING, HAND</b>		<b>2.5</b>	<b>CY</b>	<b>12.45</b>	<b>32</b>		<b>-</b>	<b>32</b>
<b>MISC &amp; GENERAL CLEANUP</b>			<b>LS</b>		<b>125</b>		<b>51</b>	<b>176</b>
<b>FLUES TO CHIMNEY 4"</b>		<b>12</b>	<b>LF</b>	<b>5.15</b>	<b>62</b>	<b>2.86</b>	<b>35</b>	<b>97</b>
<b>6"</b>		<b>12</b>	<b>LF</b>	<b>5.85</b>	<b>70</b>	<b>3.96</b>	<b>48</b>	<b>118</b>
<b>SUB-TOTAL</b>					<b>2733</b>		<b>2438</b>	<b>5171</b>
<b>LABOR INS &amp; TAXES 21%</b>					<b>574</b>			<b>574</b>
<b>SALES TAX 4.5%</b>							<b>11.0</b>	<b>110</b>
<b>SUB-TOTAL</b>								<b>5855</b>
<b>OVERHEAD 10%</b>								<b>586</b>
<b>SUB-TOTAL</b>								<b>6441</b>
<b>PROFIT 10%</b>								<b>644</b>
<b>SUB-TOTAL</b>								<b>7085</b>
<b>TOTAL</b>								<b>57085</b>



<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>APR. 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
TYPE <b>A,B &amp; C</b> SUMMARY <b>CONVERSION TO GAS</b>		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
DEMOLITION								
REMOVE 275 GAL OIL TANK,								
CLEANING & DISPOSAL		1	EA		420			420
REMOVE OIL BOILER		1	EA		320			320
PATCH PIPE OPENING		1	EA		50		20	70
NEW WORK								
GAS BOILER W/CONTROLS		1	EA		840		1600	2440
PRES. REG., VALVES ETC		1	LS		85		160	245
GAS PIPING		30	LF	4.00	120	1.84	55	175
HAND EXCAVATING		2.5	CY	34.	85			85
HOLE THRU BSMT WALL		1	EA		54			54
BACKFILLING, HAND			LS		125		51	176
FLUES TO CHIMNEY 4"		12	LF	5.15	62	2.86	35	97
6"		10	LF	5.85	59	3.96	40	99
MISC & GENERAL CLEANUP			LS		125		51	176
SUB-TOTAL					2345		2012	4357
LABOR INS & TAXES 21%					492			492
SALES TAX 4.5%							91.	91
SUB-TOTAL								4940
OVERHEAD 10%								494
SUB-TOTAL								5434
PROFIT 10%								543
SUB-TOTAL								5977
TOTAL								\$ 5977



<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED <b>APR 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>							
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>							
DRAWING NO. <b>1-60 QUARTERS</b>		ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
TYPE ALL SUMMARY		QUANTITY		LABOR		MATERIAL	
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL
REPLACE GAS HOT WATER HEATER W/SAME							
REMOVE HOT WATER HEATER					50		50
GAS HOT WATER HEATER INCLUDING PIPING AND FITTINGS WITHIN 10' OF SAME		1	EA		680	470	1150
SUB-TOTAL					730	470	1200
LABOR INS & TAXES 21%					153		153
SALES TAX 4.5%						21	21
SUB-TOTAL							1374
OVERHEAD 10%							137
SUB-TOTAL							1511
PROFIT 10%							151
SUB-TOTAL							1662
TOTAL							\$1665.

<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>APR 1991</b>		SHEET <b>OF</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>1-60 QUARTERS</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<b>ALL TYPES</b> SUMMARY		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
REPLACE OIL HOT WATER HEATER w/SAME								
REMOVE HW HEATER		1	EA		50			50
OIL HW HEATER 50 GAL		1	EA		640		1200	1840
INCLUDING PIPING & FITTINGS								
WITHIN 10' OF HEATER &								
FLUE CONNECTION								
SUB-TOTAL					690		1200	1890
LABOR, INS, & TAXES 2%					145			145
SALES TAX 4.5%							54	54
SUB-TOTAL								2089
OVERHEAD 10%								209
SUB-TOTAL								2298
PROFIT 10%								230
SUB-TOTAL								2528
TOTAL								\$ 2590.

<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>AUG '91</b>		SHEET <b>1</b> OF <b>1</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>OFFICERS QTRS-BLDG 1-60</b>				ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>		
<b>GAS to BLDGS</b> SUMMARY		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRENCH & BACKFILL		2400	LF	1.01	2424	.74	1776	4200
HAND EXCAVATION		200	CY	34.00	6800		-	6800
HAND BACKFILL		200	CY	12.45	2490		-	2490
POLYETHYLENE PIPE - 1/4"		2400	LF	1.17	2808	.55	1320	4128
BLACK STEEL PIPE - 3/4"		900	LF	3.21	2889	.87	783	3672
MAIN CONNECTION		60	EA	15.00	900	5.00	300	1200
STOP VALVES		60	EA	9.00	540	8.05	483	1023
PRESSURE REGULATORS		60	EA	10.00	600	50.00	3000	3600
HAULING		60	CY	2.21	133	4.33	260	392
DISPOSAL & MATERIAL			LS	300	300		-	300
MATERIAL HANDL. / STORAGE			LS	200	200		-	200
SEED / SOD			LS	300	300		-	300
GAS LINE TESTING		60	EA	10.00	600		-	600
GENERAL CLEAN-UP		60	EA	10.00	600		-	600
SUB-TOTAL					21,584.		7,922	29,506
LABOR, INS. & TAXES 21%					4,533.		-	4,533
SALES TAX 4.5%					-		356	356
SUB-TOTAL					26,117.		8,278	34,395
OVERHEAD 10%								3,440
SUB-TOTAL								37,835
PROFIT 10%								3,784
SUB-TOTAL								41,619
TOTAL								\$ 41,619.

$$\text{PROPORTIONAL COST / UNIT} = \frac{46,619.}{59} = \$790.$$

**E**ngineering  
**A**pplications  
**C**onsultants

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9004-B Crownwood Ct.  
Burke, Virginia 22015-1630  
(703) 978-0923

**ENGINEERING ANALYSIS**

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.00

**FUEL CONVERSION COST ANALYSIS**

**GENERAL OFFICERS' QUARTERS - TYPE 1 (1 building)**

Proposed conversion

Estimated cost of gas-fired furnace	= \$	7,085
Estimated cost of gas-fired water heater	= \$	1,665
Cost of conversion	= \$	8,750
Total Cost of Conversion	\$ 8,750 X 1	= \$ 8,750

Water heater replacement costs

Gas-fired water heaters	= \$1,665 X 1	= \$1,665
Oil-fired water heaters	= \$2,590 X 1	= \$2,590

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ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.00

FUEL CONVERSION COST ANALYSIS

GENERAL OFFICERS' QUARTERS - TYPES A, B & C (58 buildings)

Proposed conversion

Estimated cost of gas-fired furnace	= \$ 5,977
Estimated cost of gas-fired water heater	= \$ 1,665
Cost of conversion now	= \$ 7,642
Total Cost of Conversion	\$ 7,642 X 58 = \$443,236

Water heater replacement costs

Gas-fired water heaters =	\$ 1,665 X 58= \$ 96,570
Oil-fired water heaters =	\$ 2,590 X 58= \$150,220

<b>CONSTRUCTION COST ESTIMATE</b>					DATE PREPARED <b>AUG '91</b>		SHEET <b>1</b> OF <b>1</b>	
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>					BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____			
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>OFFICERS QTRS-BLDG 1-60</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<b>GAS to BLDGS</b> SUMMARY		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRENCH & BACKFILL 2400 LF 1.01 2424 .74 1776 4200								
HAND EXCAVATION 200 CY 31.00 6800 - 6800								
HAND BACKFILL 200 CY 12.45 2490 - 2490								
POLYETHYLENE PIPE - 1/4" 2400 LF 1.17 2808 .55 1320 4128								
BLACK STEEL PIPE - 3/4" 900 LF 3.21 2889 .87 783 3672								
MAIN CONNECTION 60 EA 15.00 900 5.00 300 1200								
STOP VALVES 60 EA 9.00 540 8.05 483 1023								
PRESSURE REGULATORS 60 EA 10.00 600 50.00 3000 3600								
HAULING 60 CY 2.21 133 4.33 260 392								
DISPOSAL & MATERIAL LS 300 300 - 300								
MATERIAL HANDL. / STORAGE LS 200 200 - 200								
SEED / SOD LS 300 300 - 300								
GAS LINE TESTING 60 EA 10.00 600 - 600								
GENERAL CLEAN-UP 60 EA 10.00 600 - 600								
SUB-TOTAL 21,584. 7,922 29,506								
LABOR, INS. & TAXES 21% 4,533. - 4,533								
SALES TAX 4.5% - 356 356								
SUB-TOTAL 26,117. 8,278 34,395								
OVERHEAD 10% 3,440								
SUB-TOTAL 37,835								
PROFIT 10% 3,784								
SUB-TOTAL 41,619								
TOTAL \$ 41,619.								

PROPORTIONAL COST / UNIT =  $\frac{46,619.}{47.59} = \$790.$

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ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.00

**FUEL CONVERSION COST ANALYSIS**

GENERAL OFFICERS' QUARTERS - SUMMARY OF COSTS

Type 1 (1 building)	\$ 8,750
Types A, B & C (58 buildings)	\$443,236
Cost to Govt for curb to buildings gas lines	\$ 41,619
<b>TOTAL</b>	<b>\$493,605</b>

**Replacement costs of water heaters:**

	<u>Gas-fired</u>	<u>Oil-fired</u>
Typical Building 1	\$ 1,665	\$ 2,590
Typical buildings A, B & C	\$ 96,570	\$ 150,220
<b>TOTAL</b>	<b>\$ 98,235</b>	<b>\$ 152,810</b>

PORT BELVOIR OFFICERS QUARTERS

CONSOLIDATION OF OTHER COSTS

TYPE	No.	ONE TIME REPLAC. COSTS			MAINT. COSTS	ONE TIME REPLAC. COSTS	
		MAINT. COST PER BLDG	\$/BLDG OIL WH	GAS WH		\$ OIL WH	GAS WH
I	1	10	2590	-1665	10	2590	-1665
A	19	10	2590	-1665	190	49210	-31635
B	18	10	2590	-1665	180	46620	-29970
C	21	10	2590	-1665	210	54390	-34965
TOTAL	59				590	0 152810	-98235



LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT BELVOIR REGION NO. 3 PROJECT NUMBER DACA-31-89-C-0198  
PROJECT TITLE: ENERGY SAVINGS OPPORTUNITY SURVEY FISCAL YR. 1991  
DISCRETE PORTION NAME GENERAL OFFICERS' QUARTERS - OIL TO GAS CONVERSION  
ANALYSIS DATE AUGUST 1991 ECONOMIC LIFE 20 YEARS PREPARED BY EAC

1. INVESTMENT  
A. CONSTRUCTION COST \$ 493,605  
B. SIOH \$ 27,148  
C. DESIGN COST \$ 29,616  
D. SALVAGE VALUE - \$             
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) \$ 550,369

2. ENERGY SAVINGS (+) / COST (-)  
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

	FUEL	COST \$/MBTU/YR(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELEC		\$ <u>          </u>		\$ <u>          </u>		\$ <u>          </u>
B. DIST		\$ <u>7.43</u>	<u>15,657</u>	\$ <u>116,332</u>	<u>18.26</u>	\$ <u>2,124,222</u>
C. RESID		\$ <u>6.62</u>		\$ <u>          </u>		\$ <u>          </u>
D. NG		\$ <u>5.33</u>	<u>-14,050</u>	\$ <u>-74,887</u>	<u>19.38</u>	\$ <u>-1,451,310</u>
E. COAL		\$ <u>          </u>		\$ <u>          </u>		\$ <u>          </u>
F. TOTAL			<u>1,607</u>	\$ <u>41,445</u>		\$ <u>672,912</u>

3. NONENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)  
(1) DISCOUNT FACTOR (TABLE A) 12.97 MAINT. → \$ 590  
(2) DISCOUNTED SAVING/COST (3A x 3A1) \$ 7,652

B. NONRECURRING SAVINGS (+) / COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCUR.(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAV- INGS(+) COST(-)(4)
REPL.				
(1) OIL WH	\$ <u>152,810</u>	<u>10</u>	<u>0.63</u>	\$ <u>96,270</u>
(2) GAS WH	\$ <u>-98,235</u>	<u>10</u>	<u>0.63</u>	\$ <u>-61,888</u>
(3)	\$ <u>          </u>			\$ <u>          </u>
(4) TOTAL	\$ <u>54,575</u>			\$ <u>34,382</u>

C. TOTAL NONENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 42,034

D. PROJECT NONENERGY QUALIFICATION TEST

(1) 25% MAX NONENERGY CALC (2F5 x .33) \$ 222,061  
a. IF 3D1 IS = OR > 3C GO TO ITEM 4  
b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) - 1E =             
c. IF 3D1 IS = > 1 GO TO ITEM 4  
d. IF 3D1 IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3 + 3A + (3B1d ÷ YEARS ECONOMIC LIFE) \$ 44,764

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 714,946

6. DISCOUNTED SAVINGS RATION (IF < 1 PROJECT DOES NOT QUALIFY) (S1R) = (5÷1E) = 1.3

SIMPLE PAYBACK PERIOD (YEARS) = 12.3

BUILDINGS 401 TO 432  
ROSSELL VILLAGE  
(TYPICALS)

400 AREA (ROSSELL VILLAGE)

**Fuel Conversion:**

Description - Existing oil-fired boilers used for heating and oil-fired water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -325	MBTU/year
Cost	= \$181,839	(incl. SIOH)
SIR	= 0.69	



# Rossell Village - Buildings 401 to 432

Bldg No.	Location	Bed-rooms	Sq Ft	Year
401 A	Fries Place	4	1,849	55
B	Fries Place	4	1,849	55
402 A	Fries Place	4	1,849	55
B	Fries Place	4	1,849	55
403 A	Fries Place	4	1,849	55
B	Fries Place	4	1,849	55
404 A	Fries Place	4	1,849	55
B	Fries Place	4	1,849	55
405 A	Fries Place	4	1,849	55
B	Fries Place	4	1,849	55
406 A	Fries Place	4	2,089	55
B	Fries Place	4	2,089	55
407 A	Caldwell Place	4	2,089	55
B	Caldwell Place	4	2,089	55
408 A	Caldwell Place	4	2,089	55
B	Caldwell Place	4	2,089	55
409 A	Caldwell Place	4	2,089	55
B	Caldwell Place	4	2,089	55
410 A	Caldwell Place	4	2,089	55
B	Caldwell Place	4	2,089	55
411 A	Caldwell Place	4	2,089	55
B	Caldwell Place	4	2,089	55
412 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
413 A	Presnell Place	4	2,089	55
B	Presnell Place	4	2,089	55
414 A	Presnell Place	4	2,089	55
B	Presnell Place	4	2,089	55
415 A	Rossell Place	4	2,089	55
B	Rossell Place	4	2,089	55
416 A	Rossell Place	4	2,089	55
B	Rossell Place	4	2,089	55
417 A	Rossell Place	4	2,089	55
B	Rossell Place	4	2,089	55
418 A	Lacey Place	4	2,089	55
B	Lacey Place	4	2,089	55
419 A	Lacey Place	4	2,089	55
B	Lacey Place	4	2,089	55
421 A	Lacey Place	4	2,089	55
B	Lacey Place	4	2,089	55
423 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
424 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
425 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55

Bldg No.	Location	Bed- rooms	Sq Ft	Year
426 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
427 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
428 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
429 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
430 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
431 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55
432 A	Rossell Loop	4	2,089	55
B	Rossell Loop	4	2,089	55

400 AREA (ROSSELL VILLAGE)

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# DESIGN PARAMETERS, SHGs

Location : Fort Belvoir, Virginia  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

01-23-91  
 6100190202  
 Page 1 of 1

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## DESIGN WEATHER PARAMETERS

City Name.....: Fort Belvoir  
 Location.....: Virginia  
 Latitude.....: 38.7 deg  
 Elevation.....: 69.0 ft  
 Summer Design Dry Bulb Temp.....: 90.0 F  
 Summer Design Wet Bulb Temp.....: 75.0 F  
 Daily Temperature Range.....: 23.0 F  
 Winter Design Dry Bulb Temp.....: 12.0 F  
 Atmospheric Clearness Number.....: 1.00

TABLE 1. MAXIMUM SOLAR HEAT GAINS - AVERAGE DAYS  
 (BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	24.2	61.9	98.8	111.9	98.8	61.9	24.2	24.2	80.1
Feb	31.7	75.4	106.8	115.1	106.8	75.4	31.7	31.7	107.3
Mar	40.7	87.4	107.7	108.9	107.7	87.4	40.7	40.7	136.8
Apr	59.9	97.6	104.8	97.9	104.8	97.6	59.9	49.2	164.2
May	74.7	103.1	98.7	84.7	98.7	103.1	74.7	54.9	181.6
Jun	84.9	109.2	97.9	79.8	97.9	109.2	84.9	57.8	194.9
Jul	80.4	106.6	98.5	82.0	98.5	106.6	80.4	56.4	189.0
Aug	69.0	104.2	106.2	95.1	106.2	104.2	69.0	52.1	177.5
Sep	52.3	99.7	115.4	112.4	115.4	99.7	52.3	45.3	158.1
Oct	36.3	88.9	118.8	124.1	118.8	88.9	36.3	36.3	128.3
Nov	26.6	67.2	103.2	114.9	103.2	67.2	26.6	26.6	89.5
Dec	21.3	53.7	89.1	102.7	89.1	53.7	21.3	21.3	68.5

TABLE 2. MAXIMUM SOLAR HEAT GAINS - DESIGN DAYS  
 (BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	20.2	157.9	243.4	253.9	243.4	157.9	20.2	20.2	140.3
Feb	52.5	188.6	246.3	238.2	246.3	188.6	52.5	24.6	186.3
Mar	95.5	219.4	234.8	201.8	234.8	219.4	95.5	29.3	227.8
Apr	141.3	224.3	200.7	148.1	200.7	224.3	141.3	34.1	255.2
May	165.9	220.1	171.5	106.1	171.5	220.1	165.9	37.3	267.4
Jun	173.0	215.4	157.5	89.2	157.5	215.4	173.0	47.4	269.3
Jul	163.5	215.7	167.2	102.9	167.2	215.7	163.5	38.2	264.2
Aug	136.2	216.5	193.7	143.1	193.7	216.5	136.2	35.7	250.5
Sep	89.8	206.8	224.9	195.9	224.9	206.8	89.8	30.4	220.2
Oct	51.4	182.2	238.2	231.2	238.2	182.2	51.4	25.4	183.0
Nov	20.6	155.1	239.4	250.0	239.4	155.1	20.6	20.6	139.7
Dec	18.3	140.7	235.7	254.0	235.7	140.7	18.3	18.3	120.5



STATE	Station	WINTER DESIGN DATA HEATING				DEGREE DAYS	SUMMER DESIGN DATA AIR CONDITIONING										SUMMER CRITERIA DA AIR CONDITIONING			
		Dry Bulb					Dry Bulb										Wet Bulb		Dry Bulb	
		99% 97.5% Wind Speed					Mean Daily Range										1% 2.5% 5%		≥ 93°F ≥ 80°F	
		Lat	Long	Elev	feet		°F	°F	dir	knots	annual	Heating	°F	°F	dir	°F	°F	°F	hrs	hrs
UTAH (CONT)																				
	Ogden MAP	N 41 12	112 01	4455	W	1	5	S	6	6012	93 63	91 61	26	SW	88 61	66 65	64	37	727	0 19
	Provo	40 13	111 43	4448		1	6	SE	5	5720	98 62	96 62	32	SW	94 61	66 65	64	185	989	0 26
	Salt Lake City IAP	40 46	111 58	4220		3	8	SSE	6	5983	97 62	95 62	32	N	92 61	66 65	64	139	932	0 26
	Tooele Army Depot	40 31	112 25	4700		4	7	SE	4	5941	93 61	91 61	24	N	88 60	65 64	63	41	704	0 5
	Utah Army Depot	41 15	112 00	4270		2	6	S	6	6012	94 63	92 61	26	SW	89 61	66 65	64	59	849	0 19
	Wendover AF Range	40 44	114 02	4237		8	12	ENE	4	5673	97 60	95 59	25	E	93 59	65 64	62	158	1144	0 4
VERMONT																				
	Burlington IAP	N 44 28	73 09	332	W	-12	-7	E	7	7876	88 72	85 70	24	SSW	82 69	74 72	71	4	263	67 546
	St Albans AFS	44 46	73 03	1310		-17	-11	E	9	8790	85 70	82 68	24	SSW	79 67	72 70	69	1	119	21 307
VIRGINIA																				
	Arlington Hall	N 38 52	77 06	200	W	13	17	WNW	11	4211	94 75	91 74	21	S	89 74	78 77	76	55	815	580 1744
	Bedford AFS	37 31	79 30	4220		-3	1	NW	9	7382	82 66	80 66	22	SW	77 65	69 68	67	0	87	0 216
	Cameron Station	38 48	77 07	60		13	17	WNW	11	4211	94 75	91 74	21	S	89 74	78 77	76	55	815	580 1744
	Camp A P Hill	38 08	77 21	230		10	14	NW	6	4398	96 77	93 76	21	S	90 75	80 78	77	90	897	710 1884
	Camp Pickett/Blackstone AAF	37 05	77 57	390		15	19	NW	6	3841	95 77	92 76	22	SW	90 76	79 78	77	66	905	804 2086
	Cape Charles AFS	37 08	75 57	13		20	23	N	11	3474	90 77	88 76	17	SW	86 75	79 78	77	0	596	856 2184
	Charlottesville	38 02	78 31	870		14	18	NE	7	4162	94 74	91 74	23	SW	88 73	77 76	75	54	964	376 1544
	Dahlgren NAVSURF/PNCEN	38 20	77 02	21		10	14	NW	6	4498	93 77	91 76	21	S	89 75	80 78	77	39	892	710 1884
	Dam Neck	36 47	75 57	10		19	22	N	11	3639	91 77	89 76	17	SW	87 75	79 78	77	12	708	856 2184
	Dulles IAP	38 57	77 27	313		7	11	NW	9	5010	93 74	90 73	23	S	88 73	77 76	75	28	749	386 1417
	Fort Belvoir/Davison AAF	38 43	77 11	69		8	12	NW	9	4891	92 76	90 75	23	S	88 74	78 77	76	23	781	551 1668
	Fort Eustis/Felker AAF	37 08	76 37	12		17	20	N	10	3752	92 77	90 76	17	SSW	88 75	80 78	77	26	875	807 2065
	Fort Lee	37 14	77 21	145		14	17	N	6	3939	95 76	92 76	22	SW	90 75	79 78	77	70	932	765 1973
	Fort Lee AFS	37 14	77 20	75		14	17	N	6	3939	95 76	92 76	22	SW	90 75	79 78	77	70	932	765 1973
	Fort Monroe	37 00	76 19	15		17	20	NW	9	3623	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010 2290
	Fort Myer	38 53	77 05	220		14	17	WNW	11	4211	93 75	91 74	19	S	89 74	78 77	76	41	910	580 1744
	Fort Story	36 56	76 00	13		19	22	N	11	3639	91 77	89 76	17	SW	87 75	79 78	77	12	708	856 2184
	Langley AFB/Hampton	37 05	76 21	10		17	20	NW	9	3623	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010 2290
	Little Creek NAVPHIBASE	36 54	76 09	15		20	22	NW	10	3488	93 77	91 76	19	SW	89 76	79 78	77	41	874	961 2238
	Lynchburg MAP	37 20	79 12	916		12	16	NE	7	4233	93 74	90 74	23	SW	88 73	77 76	75	31	696	376 1544
	Manassas/Davis Field	38 43	77 31	186		10	14	NW	6	4398	96 76	93 75	22	S	90 74	78 77	76	90	897	548 1650
	Newport News/Patrick Henry	37 08	76 30	41		17	20	NW	9	3549	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010 2290
	Norfolk	36 54	76 12	22		20	22	NW	10	3488	93 77	91 76	19	SW	89 76	79 78	77	41	874	961 2238

U-VALUE CALCULATION FORM

FOR ROOF/FLOOR

Project: Roswell Village, Fort Belvoir

EAC Project Number: 89034.01 Date: August 1990 By: JB

☒ Roof

☐ Floor

Material	Resistance (h-sq. ft.-F/Btu)	
	Summer	Winter
1. <u>Top Surface (Moving Air)</u>	<u>0.25</u>	<u>0.61</u>
2. <u>Bottom Surface (Still Air)</u>		<u>0.61</u>
3. <u>INSULATION</u>		<u>30.00</u>
4. <u>PLASTER</u>		<u>0.45</u>
5. _____		
6. _____		
7. _____		
8. _____		
Total (R) =		<u>31.67</u>
U = 1/R =		<u>0.032</u>

(Btu/h-sq.ft. - F)

MATERIAL	DIRECTION OF HEAT FLOW	R*	MATERIAL	R*
Air Space 3/4" (0 F)	UP	0.93	Batt/Blanket	
Air Space 4"	UP	1.03	2-2 3/4 in.	7.00
Air Space 3/4" (90 F)	DN	0.85	3-4 in.	11.00
Air Space 4"	DN	1.00	3.5 in.	13.00
Still Air	UP	0.61	5.5-6.5 in.	19.00
Still Air	DN	0.92	6-7.5 in.	22.00
Moving Air 7 1/2 MPH	ANY	0.25	9-10 in.	30.00
Moving Air 15 MPH	ANY	0.17	12-13 in.	38.00
Acoustical Tile 1/2"		1.25	Rigid Insul. 1"	2.78
Acoustical Tile 3/4"		1.89	Stryofoam 1"	4.00
Sand Plaster 3/8"		0.08	Built-up Roof 3/8"	0.33
Gypsum Plaster 1/2"		0.45	Asphalt Shingles	0.44

\*(h-sq.ft. - F/Btu)

U-VALUE CALCULATION FORM

FOR WALL/PARTITION

Project: ROSSELL VILLAGE, FORT BELVOIR

EAC Project Number: 89034.01 Date: AUGUST, 1990 By: JB

☒ Wall

☐ Partition

Material	Resistance (h-ft <sup>2</sup> - F/Btu)	
	Summer	Winter
1. <u>Outside Air</u>	<u>0.25</u>	<u>0.17</u>
2. <u>Inside Still Air</u>	<u>0.68</u>	<u>0.68</u>
3. <u>4" FACE BRICK</u>		<u>0.44</u>
4. <u>4" CINDER BLOCK</u>		<u>1.11</u>
5. <u>PLASTER</u>		<u>0.45</u>
6. _____		
7. _____		
8. _____		
Total (R) =		<u>2.85</u>
U = 1/R =		<u>0.351</u>

(Btu/h-sq.ft. - F)

MATERIAL	R*	MATERIAL	R*
Air Space 3/4" (90 F)	0.84	Blanket/Batt Insul.	
Air Space 3/4" (0 F)	1.18	2-2 3/4 in.	7.00
Still Air	0.68	3-4 in.	11.00
Moving Air 7 1/2 MPH	0.25	3.5 in.	13.00
Moving Air 15 MPH	0.17	5.5-6.5 in.	19.00
Face Brick 4"	0.44	6-7.5 in.	22.00
Cinderblock 4"	1.11	9-10 in.	30.00
Cinderblock 8"	1.72	12-13 in.	38.00
Cinderblock 12"	1.89	Rigid Insul. 1"	2.78
Gypsum Bd 3/8"	0.32	Stryofoam 1"	4.00
Gypsum Bd 1/2"	0.45	Vermiculite 1"	2.27
Gypsum Plaster 1/2"	0.45	Vapor Barr.-felt	0.06
Sand Plaster 3/8"	0.08	Fir, Pine & Simil.	
Loose Fill Sandust 1"	2.22	Woods 3/4"	0.94
Perlite Expanded 1"	2.90		

\*(h-sq.ft. - F/Btu)

ENGINEERING ANALYSIS

Sheet 1 of 1

By: JP

Calculations for Infiltration

Rosell Village - Typical

Project: ESOS, Fort Belvoir Date: August, 1990

Contract No: DACA-31-89-C-0189 EAC Project No.: 89034.01

Calculations based on ASHRAE 1989 Page F 23.14.

Building Leakage Area

	Effective Leakage Area, in <sup>2</sup>	Building Component Parameter	Building Leakage Area D <sub>L</sub> , in <sup>2</sup>
	L <sub>L</sub>	D <sub>L</sub>	L
Sill foundation	0.19/ft. of perimeter	200 ft.	38
Joints, ceiling/wall	0.12/ft. of wall	200 ft.	24
Windows	0.063/ft <sup>2</sup> . of window	438 ft <sup>2</sup> .	28
Doors	0.215/ft <sup>2</sup> . of doors	140 ft <sup>2</sup> .	30
Wall - Window frames	0.15/ft <sup>2</sup> . of window	438 ft <sup>2</sup> .	66
- Door frames	0.072/ft <sup>2</sup> . of door	140 ft <sup>2</sup> .	10
Elec. outlet/switch	0.16/ <del>fixture</del> outlet	50 <del>out.</del>	8
Recessed lights	1.6/fixture	6 <del>fix.</del>	13
Pipe penetration	0.155 <del>3.14</del> in <sup>2</sup> . of pipe	4 <del>fix.</del>	1
Exhaust Fans	6.0/fan	10 <del>4</del>	60 <del>24</del>
<del>Duct penetration</del>	<del>2.2/SF</del>	<del>1057</del>	<del>22</del>
			<u>242</u>

$$\begin{aligned} \text{Infiltration } Q(\text{cfm}) &= L \times (A \Delta t + B v^2)^{1/2} \\ &= L(0.0313 \times 51 + 0.0157 \times 14^2)^{1/2} \\ &= L \times 2.2 = 242 \times 2.2 = 532 \text{ CFM} \end{aligned}$$

$$\begin{aligned} \text{Infiltration through walls} &= 0.1 \times 360 (\text{SF}) \\ &= 360 \text{ CFM} \end{aligned}$$

<sup>92</sup>  
(ASHRAE 1989, p. 23.17)

$$\text{Total Infiltration} = 532 + 360 = 892 \text{ CFM}$$

$$\begin{aligned} \text{Infiltration Rate} &= \frac{892}{4102} = 0.217 \approx 0.2 \text{ CFM/SF} \end{aligned}$$

MASTER SCHEDULE SUMMARY

Page 1

Prepared By : E A C

04-15-91

Carrier Hourly Analysis Program

6100190202

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MASTER SCHEDULE 1. OCCUPANCY

Hourly Percentages

Hour ---->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	100	100	100	100	100	100	100	50	30	30	30	30
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100
Hour ---->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	50	30	30	30	30	50	70	100	100	100	100	100
Saturday	100	100	100	100	100	100	100	100	100	100	100	100
Sunday	100	100	100	100	100	100	100	100	100	100	100	100
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*

MASTER SCHEDULE SUMMARY

Page 1

Prepared By : E A C

04-15-91

Carrier Hourly Analysis Program

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MASTER SCHEDULE 2. HOT WATER

Hourly Percentages

Hour ----->	0	1	2	3	4	5	6	7	8	9	10	11
Weekday	10	3	1	1	1	1	3	15	65	70	85	70
Saturday	10	3	1	1	1	1	3	15	65	70	85	70
Sunday	10	3	1	1	1	1	3	15	65	70	85	70
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

Hour ----->	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	60	55	50	45	40	45	50	60	75	70	65	60
Saturday	60	55	50	45	40	45	50	60	75	70	65	60
Sunday	60	55	50	45	40	45	50	60	75	70	65	60
DESIGN	100	100	100	100	100	100	100	100	100	100	100	100

\*\*\*\*\*

PROJECTED NAVFAC COST INDEX  
MONTHLY  
JULY 1989

YEAR	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1974	1156	1154	1155	1177	1177	1199	1233	1240	1238	1246	1239	1240
1975	1242	1265	1265	1269	1287	1307	1317	1330	1333	1351	1349	1354
1976	1362	1370	1378	1391	1398	1416	1425	1455	1467	1476	1479	1484
1977	1489	1499	1504	1506	1507	1521	1539	1554	1587	1617	1603	1606
1978	1609	1617	1620	1621	1652	1663	1696	1705	1720	1721	1732	1734
1979	1740	1740	1750	1749	1753	1809	1829	1849	1900	1899	1902	1909
1980	1895	1894	1915	1899	1888	1916	1950	1971	1976	1981	2000	2017
1981	2015	2016	2014	2064	2076	2083	2109	2118	2139	2156	2186	2184
1982	2184	2200	2195	2195	2220	2219	2233	2253	2249	2248	2260	2295
1983	2311	2348	2352	2347	2351	2388	2414	2428	2430	2416	2419	2406
1984	2402	2407	2412	2422	2419	2417	2418	2428	2430	2424	2421	2408
1985	2410	2414	2406	2405	2411	2429	2448	2442	2440	2441	2446	2439
1986	2440	2446	2447	2458	2479	2493	2499	2498	2504	2511	2511	2511
1987	2515	2510	2518	2523	2524	2525	2538	2557	2565	2569	2564	2589
1988	2574	2576	2586	2591	2592	2595	2598	2611	2612	2612	2616	2617
1989	2619	2613	2616	2620	2621	2626	2633	2640	2648	2655	2663	2670
1990	2677	2683	2690	2697	2704	2710	2717	2724	2731	2738	2744	2751
1991	2757	2763	2769	2776	2782	2788	2794	2800	2806	2812	2819	2825
1992	2830	2835	2840	2845	2850	2855	2861	2866	2871	2876	2881	2886
1993	2891	2896	2900	2905	2910	2914	2919	2924	2928	2933	2938	2942

ANNUAL MARK-UP FACTORS FOR ESCALATION  
(BEYOND FY 93, USE 1.80% ESCALATION COMPOUNDED EACH YEAR)

FISCAL-YEAR	4-87	4-88	4-89	4-90	4-91	4-92	4-93	4-94	4-95
4-83	1.07	1.10	1.12	1.15	1.18	1.21	1.24	1.26	1.28
4-84	1.04	1.07	1.08	1.11	1.15	1.17	1.20	1.22	1.24
4-85	1.05	1.08	1.09	1.12	1.15	1.18	1.21	1.23	1.25
4-86	1.03	1.05	1.07	1.10	1.13	1.16	1.18	1.20	1.22
4-87	1.00	1.03	1.04	1.07	1.10	1.13	1.15	1.17	1.19
4-88	0.97	1.00	1.01	1.04	1.07	1.10	1.12	1.14	1.16
4-89	0.96	0.99	1.00	1.03	1.06	1.09	1.11	1.13	1.15
4-90	0.94	0.96	0.97	1.00	1.03	1.05	1.08	1.10	1.12
4-91	0.91	0.93	0.94	0.97	1.00	1.02	1.05	1.07	1.08
4-92	0.89	0.91	0.92	0.95	0.98	1.00	1.02	1.04	1.06
4-93	0.87	0.89	0.90	0.93	0.96	0.98	1.00	1.02	1.04

NOTE: Escalation rate change to be 1.80% after 1993.

Figure 9  
Projected NAVFAC Cost Index

## STUDY PARAMETER INPUT PRINTOUT

Prepared By : E A C  
Advanced Engineering Economic Analysis Program

05-01-91  
60901891.00  
Page 1 of 1

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STUDY CRITERIA-----  
ECIP - FEMP/10CFR436A (Army TM 5-802-1, Para. 2-3&4)  
-----

Discount Rate	:	7.0 %
Investment Credit	:	10.0 %
Payment Time	:	1.0 (1 = end of year)

  
-----\*\*\*\*\*  
KEY STUDY DATES-----  
ECIP Economic Life : 15 (years)  
-----\*\*\*\*\*  
ENERGY RELATED STUDY PARAMETERS-----

State	:	VA
Prices of Electricity	:	18.05
Distillate Oil	:	7.43
Residual Oil	:	6.62
Natural Gas	:	5.33
Coal	:	0.00

  
-----Prices are specified in \$ / Million BTU, FEMP Date (JUL 1988)  
-----\*\*\*\*\*  
STUDY IDENTIFICATION BLOCK-----

Project Title	:	FORT BELVOIR E.S.O.S
Installation Name	:	ROSSELL VILLAGE
Project Number	:	DACA-31-89-C-0198
Fiscal Year	:	1991
Name of Analyst	:	E A C, P.C. Burke, Va.

  
-----



## SIMPLE SPACE DESCRIPTION

Space Name : Rossell Village type 1

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	1.00
Color :	M	M		Internal Shades :	? N

People : sqft/person = 500.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 2    Wattage Mult. = 1.00  
       : Fixture Type = 3 Free-hanging

SPACE NAME = Rossell Village type 1

		Floor Area :	1,849.0 sqft
Exposure :	E	W Roof Area :	924.0 sqft
Wall Area :	632.0	Current	
Glass Area :	90.0	99.0 Elements :	Pt,Wl,Gl,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Partition

Area = 600.0 sqft    Uncond. Space Temp:Cooling = 90.0 F  
 U-Value = 0.543 BTU/hr/sqft/F    Uncond. Space Temp:Heating = 50.0 F

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	338.0 sqft
U-Value =	0.351 BTU/hr/sqft/F		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	45.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area =	324.0 sqft
Perimeter =	45.0 ft
Depth =	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling :	0.22 CFM/sqft =	407 CFM
Heating :	0.22 CFM/sqft =	407 CFM
Typical :	0.22 CFM/sqft =	407 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Rossell Village type 2

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	1.00
Color :	M	M		Internal Shades :	N

People : sqft/person = 500.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

SPACE NAME = Rossell Village type 2

Exposure :	E	W	Floor Area :	1,849.0 sqft
Wall Area :	632.0	598.0	Roof Area :	924.0 sqft
Glass Area :	90.0	99.0	Current Elements :	Pt,Wl,Gl,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Partition

Area = 250.0 sqft Uncond. Space Temp:Cooling = 90.0 F  
 U-Value = 0.543 BTU/hr/sqft/F Uncond. Space Temp:Heating = 50.0 F

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	338.0 sqft
U-Value =	0.351 BTU/hr/sqft/F		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	45.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area =	674.0 sqft
Perimeter =	65.0 ft
Depth =	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling :	0.22 CFM/sqft =	407 CFM
Heating :	0.22 CFM/sqft =	407 CFM
Typical :	0.22 CFM/sqft =	407 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Rossell Village type 3

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	1.00
Color :	M	M		Internal Shades ?	N

People : sqft/person = 500.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 2    Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = Rossell Village type 3

		Floor Area :	2,089.0 sqft
Exposure :	E	W Roof Area :	1,044.0 sqft
Wall Area :	723.0	Current	
Glass Area :	90.0	Elements :	Pt,Wl,Gl,Gr,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Partition

Area = 600.0 sqft    Uncond. Space Temp:Cooling = 90.0 F  
 U-Value = 0.543 BTU/hr/sqft/F    Uncond. Space Temp:Heating = 50.0 F

\*\*\*\*\*

ADDITIONAL ELEMENT - Wall

Weight = M (lb/sqft)    Exposure = S  
 Color = M    Net Area = 338.0 sqft  
 U-Value = 0.351 BTU/hr/sqft/F

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value = 0.550 BTU/hr/sqft/F    Exposure = S  
 Glass Factor = 0.90    Area = 45.0 sqft  
 Internal Shades ?    N

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area = 444.0 sqft  
 Perimeter = 45.0 ft  
 Depth = 0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling : 0.22 CFM/sqft = 460 CFM  
 Heating : 0.22 CFM/sqft = 460 CFM  
 Typical : 0.22 CFM/sqft = 460 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Rossell Village type 4

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	1.00
Color :	M	M		Internal Shades ?	N

People : sqft/person = 500.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = Rossell Village type 4

		Floor Area :	2,089.0 sqft
Exposure :	E	W Roof Area :	1,044.0 sqft
Wall Area :	723.0	Current	
Glass Area :	90.0	99.0 Elements :	Pt,Wl,Gl,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Partition

Area = 250.0 sqft Uncond. Space Temp:Cooling = 90.0 F  
 U-Value = 0.543 BTU/hr/sqft/F Uncond. Space Temp:Heating = 50.0 F

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	338.0 sqft
U-Value =	0.351 BTU/hr/sqft/F		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	45.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area =	794.0 sqft
Perimeter =	65.0 ft
Depth =	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling :	0.22 CFM/sqft =	460 CFM
Heating :	0.22 CFM/sqft =	460 CFM
Typical :	0.22 CFM/sqft =	460 CFM

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Fort Belvoir, Virginia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

04-15-91  
 6100190202  
 Page 1 of 1

\*\*\*\*\*  
 CALCULATION DATA:

Zone Name : Building 401                      Calc Time: Winter design  
 Job Name : Fort Belvoir                      Amb db : 12.0 F

\*\*\*\*\*

Space Name		Mult	Space Sensible (BTU/hr/space)	Water Flow (gpm/space)
Rossell Village type 1	x	1	78,884.9	6.4
Rossell Village type 2	x	1	75,995.9	6.1

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building 401

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	61,641
ROOF TRANSMISSION	3,312
GLASS TRANSMISSION	14,414
TRANSMISSION LOSS TO UNCOND. SPACES	8,308
INFILTRATION LOSS	49,080
SLAB FLOOR	4,045
HEATING SAFETY BTU/hr	14,080
SUB-TOTAL	154,881
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	154,881
HOT WATER TEMPERATURE DROP	25.0 deg F
ZONE BASEBOARD WATER FLOW	12.47 gpm
VENTILATION PREHEAT WATER FLOW	0.00 gpm
TOTAL WATER FLOW REQ'D	12.47 gpm
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Building 401 Oil

04-20-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = Building 401 Oil  
Cooling Plant Type = User Defined  
Heating Plant Type = Combustion

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Building 401	1		

\*\*\*\*\*

### 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

#### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90	100	60	100	30	100
80	100	50	100	20	100
70	100	40	100	10	100

\*\*\*\*\*

### 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 140.80 MBH  
Fuel type = Fuel Oil  
Rated plant output = 229.6 MBH  
Type of heating = Hydronic  
Is plant efficiency computer generated ? N  
Seasonal plant efficiency = 70 %

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

Hot water pumping system head = 20.00 ft wg  
Hot water pumping system delta T = 20.00 F

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : Building 401 Oil  
 Prepared By: E A C  
 Carrier Hourly Analysis Program

04-23-91  
 6100190202  
 Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 401 Oil

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW  
 Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y  
 Maximum hourly hot water use = 14.0 gal  
 Hot water schedule = 2  
 Average entering water temperature = 57.0 F  
 Average hot water supply temperature = 140.0 F  
 Heating plant type = 2 : Combustion  
 Fuel type = 2 : Fuel Oil  
 Plant capacity = 180.0 MBH  
 Is plant efficiency computer generated ? N  
 Annual plant efficiency = 62 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft  
 Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 401 Oil	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	ELECTRIC (generic)	MBTU
Natural Gas	3	NATURAL GAS (generic)	MBTU
Fuel Oil	4	DISTILLATE FUEL OIL (generic)	MBTU
Propane	8	Propane (generic)	MBTU
Remote Source Heating	9	Remote source heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*



## ANNUAL COMPONENT COSTS

Building : Building 401 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	0	0.000	0.0 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	156	0.042	72.4 %
Pumps	1	0.000	0.7 %
>>> HVAC Subtotal	157	0.043	73.1 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	58	0.016	26.9 %
>>> Non-HVAC Sub-total	58	0.016	26.9 %
>>> GRAND TOTAL	215	0.058	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 3,698 sqft  
 Conditioned floor area = 3,698 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 401 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Page 1 of 1

Carrier Hourly Analysis Program

\*\*\*\*\*

TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<--- Annual Costs * --->		% of Total
		(MBTU)	(MBTU/sqft)	
Electric	418 kWh	1	0.000	0.7 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	1124 gallon	156	0.042	72.4 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		157	0.043	73.1 %
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	418 gallon	58	0.016	26.9 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		58	0.016	26.9 %
*****				
>>> GRAND TOTAL		215	0.058	100.0 %
*****				

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 3,698 sqft  
 Conditioned floor area = 3,698 sqft

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Building 401 Gas

04-23-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = Building 401 Gas  
Cooling Plant Type = User Defined  
Heating Plant Type = Combustion

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Building 401	1		

\*\*\*\*\*

### 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

#### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90 -----	100	60 -----	100	30 -----	100
80 -----	100	50 -----	100	20 -----	100
70 -----	100	40 -----	100	10 -----	100

\*\*\*\*\*

### 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 140.80 MBH  
Fuel type = Natural Gas  
Rated plant output = 229.6 MBH  
Type of heating = Hydronic  
Is plant efficiency computer generated ? N  
Seasonal plant efficiency = 66 %

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

Hot water pumping system head = 20.00 ft wg  
Hot water pumping system delta T = 20.00 F

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : Building 401 Gas

04-23-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 401 Gas

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 14.0 gal

Hot water schedule = 2

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 1 : Natural Gas

Plant capacity = 180.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 62 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 401 Gas	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	ELECTRIC (generic)	MBTU
Natural Gas	3	NATURAL GAS (generic)	MBTU
Fuel Oil	4	DISTILLATE FUEL OIL (generic)	MBTU
Propane	8	Propane (generic)	MBTU
Remote Source Heating	9	Remote source heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

04-23-91

Building : Building 401 Gas  
Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C

Page 1 of 1

Carrier Hourly Analysis Program

\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	0	0.000	0.0 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	165	0.045	73.6 %
Pumps	1	0.000	0.6 %
>>> HVAC Subtotal	167	0.045	74.2 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	58	0.016	25.8 %
>>> Non-HVAC Sub-total	58	0.016	25.8 %
>>> GRAND TOTAL	225	0.061	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
building floor area. For this building:

Gross floor area = 3,698 sqft

Conditioned floor area = 3,698 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 401 Gas  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * -->		% of Total
		(MBTU)	(MBTU/sqft)	
Electric	418 kWh	1	0.000	0.6 %
Natural Gas	1653 Therms	165	0.045	73.6 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		167	0.045	74.2 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	580 Therms	58	0.016	25.8 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		58	0.016	25.8 %
-----				
>>> GRAND TOTAL		225	0.061	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 3,698 sqft  
 Conditioned floor area = 3,698 sqft

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Fort Belvoir, Virginia

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building 406

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 12.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Water Flow (gpm/space)
Rossell Village type 3	x 1	86,606.6	7.0
Rossell Village type 4	x 1	83,717.6	6.7

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia

04-15-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building 406

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	68,796
ROOF TRANSMISSION	3,742
GLASS TRANSMISSION	14,414
TRANSMISSION LOSS TO UNCOND. SPACES	8,308
INFILTRATION LOSS	55,451
SLAB FLOOR	4,129
HEATING SAFETY BTU/hr	15,484
SUB-TOTAL	170,324
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	170,324
HOT WATER TEMPERATURE DROP	25.0 deg F
ZONE BASEBOARD WATER FLOW	13.71 gpm
VENTILATION PREHEAT WATER FLOW	0.00 gpm
TOTAL WATER FLOW REQ'D	13.71 gpm
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*



# PLANT DESCRIPTIONS

Plant : Building 406 Oil

04-22-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = Building 406 Oil  
Cooling Plant Type = User Defined  
Heating Plant Type = Combustion

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Building 406	1		

\*\*\*\*\*

### 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

#### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90 -----	100	60 -----	100	30 -----	100
80 -----	100	50 -----	100	20 -----	100
70 -----	100	40 -----	100	10 -----	100

\*\*\*\*\*

### 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 154.84 MBH  
Fuel type = Fuel Oil  
Rated plant output = 229.6 MBH  
Type of heating = Hydronic  
Is plant efficiency computer generated ? N  
Seasonal plant efficiency = 70 %

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

Hot water pumping system head = 20.00 ft wg  
Hot water pumping system delta T = 20.00 F

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : Building 406 Oil

04-23-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 406 Oil

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 14.0 gal

Hot water schedule = 2

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 2 : Fuel Oil

Plant capacity = 180.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 62 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 406 Oil	1		

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	ELECTRIC (generic)	MBTU
Natural Gas	3	NATURAL GAS (generic)	MBTU
Fuel Oil	4	DISTILLATE FUEL OIL (generic)	MBTU
Propane	8	Propane (generic)	MBTU
Remote Source Heating	9	Remote source heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Building 406 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	0	0.000	0.0 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	184	0.044	75.5 %
Pumps	2	0.000	0.6 %
>>> HVAC Subtotal	185	0.044	76.2 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	58	0.014	23.8 %
>>> Non-HVAC Sub-total	58	0.014	23.8 %
>>> GRAND TOTAL	243	0.058	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,178 sqft  
 Conditioned floor area = 4,178 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 406 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Page 1 of 1

Carrier Hourly Analysis Program

\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	443 kWh	2	0.000	0.6 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	1324 gallon	184	0.044	75.5 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		185	0.044	76.2 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	418 gallon	58	0.014	23.8 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		58	0.014	23.8 %
-----				
>>> GRAND TOTAL		243	0.058	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,178 sqft  
 Conditioned floor area = 4,178 sqft

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Building 406 Gas

04-23-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = Building 406 Gas  
Cooling Plant Type = User Defined  
Heating Plant Type = Combustion

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Building 406	1		

\*\*\*\*\*

### 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90	100	60	100	30	100
80	100	50	100	20	100
70	100	40	100	10	100

\*\*\*\*\*

### 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 154.84 MBH  
Fuel type = Natural Gas  
Rated plant output = 229.6 MBH  
Type of heating = Hydronic  
Is plant efficiency computer generated ? N  
Seasonal plant efficiency = 66 %

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

Hot water pumping system head = 20.00 ft wg  
Hot water pumping system delta T = 20.00 F

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : Building 406 Gas

04-23-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 406 Gas

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 1

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 14.0 gal

Hot water schedule = 2

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 2 : Combustion

Fuel type = 1 : Natural Gas

Plant capacity = 180.0 MBH

Is plant efficiency computer generated ? N

Annual plant efficiency = 62 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 406 Gas	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	ELECTRIC (generic)	MBTU
Natural Gas	3	NATURAL GAS (generic)	MBTU
Fuel Oil	4	DISTILLATE FUEL OIL (generic)	MBTU
Propane	8	Propane (generic)	MBTU
Remote Source Heating	9	Remote source heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Building 406 Gas  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	0	0.000	0.0 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	195	0.047	76.6 %
Pumps	2	0.000	0.6 %
-----			
>>> HVAC Subtotal	196	0.047	77.2 %
-----			
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	58	0.014	22.8 %
-----			
>>> Non-HVAC Sub-total	58	0.014	22.8 %
=====			
>>> GRAND TOTAL	254	0.061	100.0 %
=====			

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,178 sqft  
 Conditioned floor area = 4,178 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 406 Gas  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-23-91  
 6100190202

Page 1 of 1

Carrier Hourly Analysis Program

\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * -->		% of Total
		(MBTU)	(MBTU/sqft)	
Electric	443 kWh	2	0.000	0.6 %
Natural Gas	1947 Therms	195	0.047	76.6 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		196	0.047	77.2 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	580 Therms	58	0.014	22.8 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		58	0.014	22.8 %
-----				
>>> GRAND TOTAL		254	0.061	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,178 sqft  
 Conditioned floor area = 4,178 sqft

\*\*\*\*\*



### 400 AREA (ROSSELL VILLAGE)

#### **Fuel Conversion:**

Description - Existing oil-fired boilers used for heating and oil-fired water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -325	MBTU/year
Cost	= \$181,839	(incl. SIOH)
SIR	= 0.69	

PORT BELVOIR ROSSELL HOUSING AREA

CONSTRUCTION COSTS AND ENERGY SAVINGS CONSOLIDATION

TYPICAL BLDG	No.	ENERGY SAVINGS, MBTU/BLDG			TOTAL ENERGY SAVINGS, MBTU		
		ELEC.	OIL	GAS	ELEC.	OIL	GAS
401	5	0	214	-224	0	1070	-1120
406	25	0	184	-195	0	4600	-4875
TOTAL	30				0	5670	-5995

Engineering  
Applications  
Consultants

A Professional  
Corporation

9004-B Crownwood Ct.  
Burke, Virginia 22015-1630  
(703) 978-0923

---

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

Rossell Village - TYPICAL BUILDING

Proposed conversion

Estimated cost of gas burner in existing boiler	= \$ 3,538
Estimated cost of gas-fired water heater	= \$ 647
Cost of conversion	= \$ 4,185
Total Cost of Conversion	\$ 4,185 X 30= \$ 125,750

Replacement costs

Replace boiler, retain gas burner	\$ 2,821 X 30= \$ 84,630
Gas-fired water heaters	\$ 647 X 30= \$ 19,410
Oil-fired water heaters	\$ 2,247 X 30= \$ 67,410

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Typical Building  
Rossell Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Replace oil burner with gas burner  
Gas water heaters

Gas burner in existing boiler:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas burner	1	EA	\$210	\$210	\$795	\$795	\$1,005
Remove oil tank	1	EA	\$1,000	\$1,000	\$15	\$15	\$1,015
Valves etc.		LS	----	\$75	----	\$500	\$575
SUB-TOTAL:				\$1,285		\$1,310	\$2,595
Labor Markup: 21%				\$270		---	\$270
Taxes: 4.5%				---		\$59	\$59
SUB-TOTAL:				\$1,555		\$1,369	\$2,924
Overhead: 10%				\$155		\$137	\$292
SUB-TOTAL:				\$1,710		\$1,506	\$3,216
Profit: 10%				\$171		\$151	\$322
TOTAL:				\$1,881		\$1,656	\$3,538

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Typical Building  
Rossell Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Replace oil burner with gas burner  
Gas water heaters

Replace boiler, retain gas burner

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Replace boiler	1	each	\$1,050	\$1,050	\$1,015	\$1,015	\$2,065
SUB-TOTAL:				\$1,050		\$1,015	\$2,065
Labor Markup: 21%				\$221		---	\$221
Taxes: 4.5%				---		\$46	\$46
SUB-TOTAL:				\$1,271		\$1,061	\$2,331
Overhead: 10%				\$127		\$106	\$233
SUB-TOTAL:				\$1,398		\$1,167	\$2,564
Profit: 10%				\$140		\$117	\$256
TOTAL:				\$1,537		\$1,283	\$2,821

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Typical Building  
Rossell Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Replace oil burner with gas burner  
Gas water heaters

Gas water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas water heater	1	each	\$265	\$265	\$205	\$205	\$470
SUB-TOTAL:				\$265		\$205	\$470
Labor Markup: 21%				\$56	---	---	\$56
Taxes: 4.5%				---		\$9	\$9
SUB-TOTAL:				\$321		\$214	\$535
Overhead: 10%				\$32		\$21	\$53
SUB-TOTAL:				\$353		\$236	\$588
Profit: 10%				\$35		\$24	\$59
TOTAL:				\$388		\$259	\$647

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Typical Building  
Rossell Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 1: Oil boiler  
Oil water heater

Replace oil water heater now:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Replace oil water heater	1	each	\$395	\$395	\$1,320	\$1,320	\$1,715
SUB-TOTAL:				\$395		\$1,320	\$1,715
Labor Markup: 21%				\$83		---	\$83
Taxes: 4.5%				---		\$59	\$59
SUB-TOTAL:				\$478		\$1,379	\$1,857
Overhead: 10%				\$48		\$138	\$186
SUB-TOTAL:				\$526		\$1,517	\$2,043
Profit: 10%				\$53		\$152	\$204
TOTAL:				\$578		\$1,669	\$2,247

CONSTRUCTION COST ESTIMATE				DATE PREPARED. AUG '91		SHEET 1 OF 1	
PROJECT ENERGY SAVINGS OPPORTUNITY SURVEY				BASIS FOR ESTIMATE			
LOCATION FT. BELVOIR, VIRGINIA				<input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) VP			
ARCHITECT ENGINEER ENGINEERING APPLICATIONS CONSULTANTS							
DRAWING NO. ROSSELL VILLAGE (400 AREA)		ESTIMATOR REF		CHECKED BY			
GAS TO BLDGS. SUMMARY	QUANTITY		LABOR		MATERIAL		TOTAL COST
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRENCH & BACKFILL	1200	LF	1.01	1212	.74	888	2100
HAND EXCAVATING	200	CY	34.00	6800		-	6800
HAND BACKFILLING	200	CY	12.45	2490		-	2490
POLYETHYLENE PIPE - 1 1/4"	1800	LF	1.17	2106	.55	990	3096
BLACK STEEL PIPE - 3/4"	2400	LF	3.21	7704	.87	2088	9792
MAIN CONNECTION	60	EA	15.00	900	5.00	300	1200
STOP VALVES - 3/4"	60	EA	9.00	540	8.05	483	1023
PRESSURE REGULATORS	30	EA	10.00	300	50.00	1500	1800
SIDEWALK REPAIR	1000	SF	.94	940	1.26	1260	2200
HAULING	60	CY	2.21	133	4.33	260	392
DISPOSAL OF MATERIALS		LS		300		-	300
MATERIAL HANDL./STORAGE		LS		200		-	200
SEED/SOD		LS		300		-	300
GAS LINE TESTING	60	EA	10.00	600		-	600
GENERAL CLEAN-UP	60	EA	10.00	600		-	600
SUB-TOTAL				25,125		7,769	32,894
LABOR, INS. & TAXES 21%				5,276		-	5276
SALES TAX 4.5%				-		350	350
SUB-TOTAL				30,401		8,119	38,520
OVERHEAD 10%							3,852
SUB-TOTAL							42,372
PROFIT 10%							4,237
SUB-TOTAL							46,609
TOTAL							\$ 46,609

$$\text{PROPORTIONATE COST / UNIT} = \frac{46609.}{30} = \text{APPROX } \$1555.$$



Engineering  
Applications  
Consultants

A Professional  
Corporation

9004-B Crownwood Ct.  
Burke, Virginia 22015-1630  
(703) 978-0923

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

Rossell Village - SUMMARY OF COSTS

Typical Building ( 30 buildings) = \$125,750

Cost to Govt for curb to  
buildings gas lines = \$ 46,609

**TOTAL** = \$172,359

Replacement costs

Replace boiler, retain gas burner \$2,821 X 30 = \$ 84,630

Gas-fired water heaters \$ 647 X 30 = \$ 19,410

Oil-fired water heaters \$2,247 X 30 = \$ 67,410

PORT BELVOIR ROSSELL HOUSING AREA

CONSOLIDATION OF OTHER COSTS

TYP. BLDG	No.	MAINT. COST PER BLDG	ONE TIME REPL COSTS		MAINT. COSTS	ONE TIME REPL COST	
			\$ OIL WH	\$ PER BLDG GAS WH		\$ OIL WH	\$ GAS WH
401	5	20	2247	-647	100	11235	-3235
406	25	20	2247	-647	500	56175	-16175
TOTAL	30				600	67410	-19410

LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: FORT BELVOIR REGION NO. 3 PROJECT NUMBER DACA-31-89-C-0198  
PROJECT TITLE: ENERGY SAVINGS OPPORTUNITY SURVEY FISCAL YR. 1991  
DISCRETE PORTION NAME ROSSELL VILLAGE - OIL TO GAS CONVERSION  
ANALYSIS DATE AUGUST 1991 ECONOMIC LIFE 20 YEARS PREPARED BY EAC

1. INVESTMENT

A. CONSTRUCTION COST	\$	<u>172,359</u>	
B. SIOH	\$	<u>9,480</u>	
C. DESIGN COST	\$	<u>10,342</u>	
D. SALVAGE VALUE	-	<u>\$</u>	
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)			\$ <u>192,181</u>

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL	COST \$/MBTU/YR (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELEC	\$		\$		\$
B. DIST	\$ <u>7.43</u>	<u>5,670</u>	\$ <u>42,128</u>	<u>18.26</u>	\$ <u>769,257</u>
C. RESID	\$ <u>6.62</u>		\$		\$
D. NG	\$ <u>5.33</u>	<u>-5,995</u>	\$ <u>-31,953</u>	<u>19.38</u>	\$ <u>-619,249</u>
E. COAL	\$		\$		\$
F. TOTAL		<u>-325</u>	\$ <u>10,175</u>		\$ <u>150,008</u>

3. NONENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)  
(1) DISCOUNT FACTOR (TABLE A) 12.97 \$ 600  
(2) DISCOUNTED SAVING/COST (3A x 3A1) \$ 7,782

B. NONRECURRING SAVINGS (+) / COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR (3)	DISCOUNTED SAV- INGS (+) COST (-) (4)
REPL.				
(1) OIL WH	\$ <u>67,410</u>	<u>10</u>	<u>0.63</u>	\$ <u>42,468</u>
(2) GAS WH	\$ <u>-19,410</u>	<u>10</u>	<u>0.63</u>	\$ <u>-12,228</u>
(3) BOILER (INCL. SIOH)	\$ <u>-89,285</u>	<u>10</u>	<u>0.63</u>	\$ <u>-56,249</u>
(4) TOTAL	\$ <u>-41,285</u>			\$ <u>-26,009</u>

C. TOTAL NONENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ -18,227

D. PROJECT NONENERGY QUALIFICATION TEST

(1) 25% MAX NONENERGY CALC (2F5 x .33) \$ 49,503  
a. IF 3D1 IS = OR > 3C GO TO ITEM 4  
b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) - 1E = \_\_\_\_\_  
c. IF 3D1 IS = > 1 GO TO ITEM 4  
d. IF 3D1 IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3 + 3A + (3B1d ÷ YEARS ECONOMIC LIFE) \$ 8,711

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 131,781

6. DISCOUNTED SAVINGS RATION (IF < 1 PROJECT DOES NOT QUALIFY) (S1R) = (5÷1E) = 0.69

SIMPLE PAYBACK PERIOD (YEARS) = 22.0

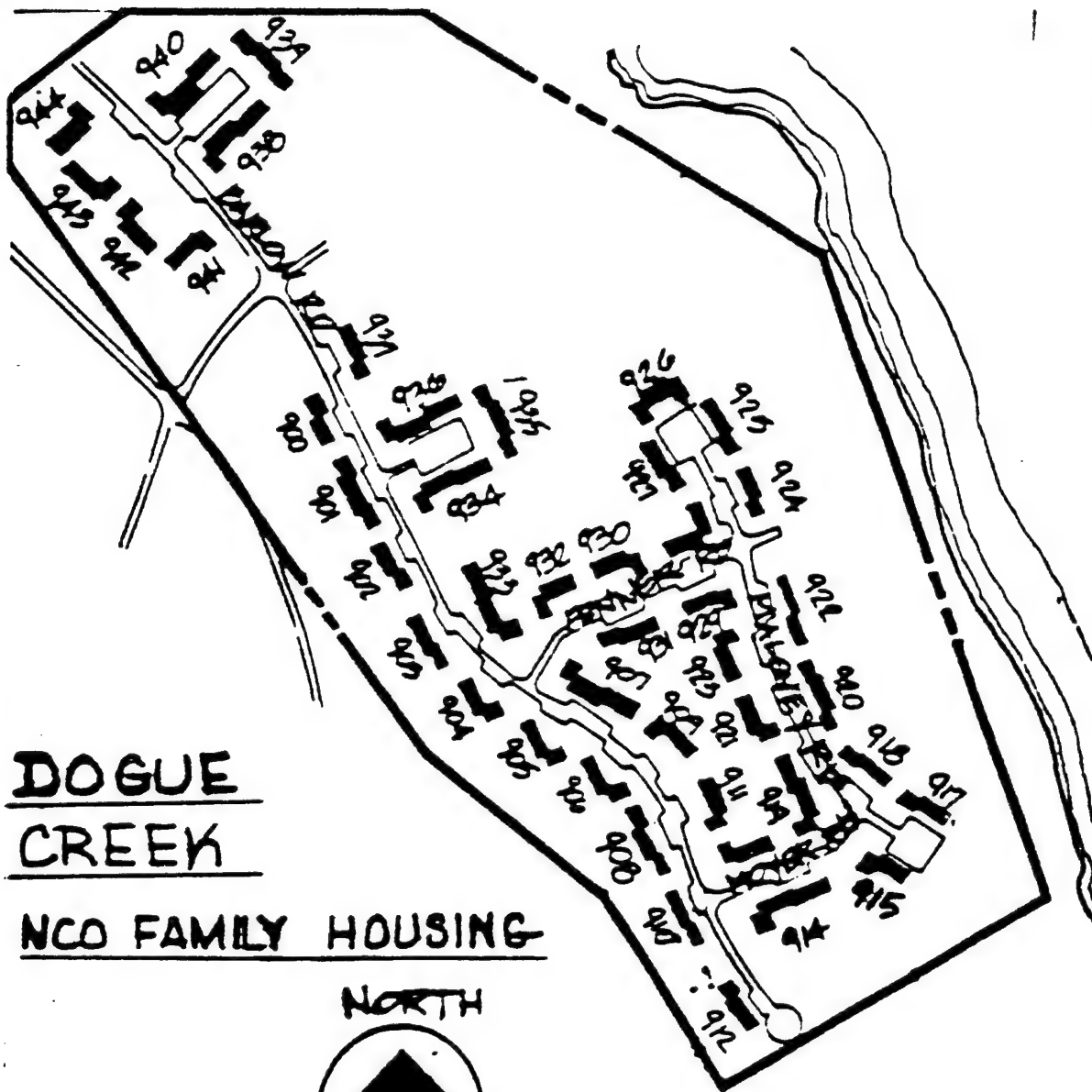
BUILDINGS 900 TO 944  
DOGUE CREEK VILLAGE  
(TYPICALS)

900 AREA (DOGUE CREEK)

**Fuel Conversion:**

Description - Existing oil-fired furnaces used for heating and electric water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -23	MBTU/year
Cost	= \$205,446	(incl. SIOH)
SIR	= 3.84	



DOGUE  
CREEK

NCO FAMILY HOUSING

NORTH



Dogue Creek Village

Bldg No.	Location	Bed-rooms	Sq Ft	Year
900	A Barlow Road	2	1,137	56
	B Barlow Road	2	1,137	56
	C Barlow Road	2	1,137	56
	D Barlow Road	2	1,137	56
	E Barlow Road	3/B	1,264	56
901	A Barlow Road	3/B	1,264	56
	B Barlow Road	3	1,264	56
	C Barlow Road	3	1,264	56
	D Barlow Road	3	1,264	56
	E Barlow Road	3	1,264	56
	F Barlow Road	3/B	1,264	56
902	A Barlow Road	3/B	1,264	56
	B Barlow Road	2	1,137	56
	C Barlow Road	2	1,137	56
	D Barlow Road	2	1,137	56
	E Barlow Road	2	1,137	56
903	A Barlow Road	3/B	1,264	56
	B Barlow Road	3	1,264	56
	C Barlow Road	3	1,264	56
	D Barlow Road	3	1,264	56
	E Barlow Road	3	1,264	56
904	A Barlow Road	3/B	1,264	56
	B Barlow Road	3	1,264	56
	C Barlow Road	3	1,264	56
	D Barlow Road	3	1,264	56
	E Barlow Road	3	1,264	56
905	A Barlow Road	3/B	1,264	56
	B Barlow Road	3	1,264	56
	C Barlow Road	3	1,264	56
	D Barlow Road	3	1,264	56
	E Barlow Road	3	1,264	56
906	A Barlow Road	3/B	1,264	56
	B Barlow Road	3	1,264	56
	C Barlow Road	3	1,264	56
	D Barlow Road	3	1,264	56
	E Barlow Road	3	1,264	56
907	A Fenner Road	3/B	1,264	56
	B Barlow Road	2	1,137	56
	C Barlow Road	2	1,137	56
	D Barlow Road	2	1,137	56

Bldg No.	Location	Bed-rooms	Sq Ft	Year
907 E	Barlow Road	2	1,137	56
F	Barlow Road	3	1,264	56
G	Barlow Road	3	1,264	56
H	Barlow Road	3	1,264	56
I	Barlow Road	3	1,264	56
908 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
F	Barlow Road	3/B	1,264	56
909 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
910 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
911 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3/B	1,264	56
912 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	2/B	1,137	56
913 A	Barlow Road	3/B	1,264	56
B	Moyer Road	3	1,264	56
C	Moyer Road	3	1,264	56
D	Moyer Road	3	1,264	56
E	Moyer Road	3	1,264	56
914 A	Moyer Road	3	1,264	56
B	Moyer Road	3	1,264	56
C	Moyer Road	3	1,264	56
D	Moyer Road	3	1,264	56
E	Moyer Road	2	1,137	56
F	Moyer Road	2	1,137	56
G	Moyer Road	2	1,137	56
H	Moyer Road	2	1,137	56
I	Moyer Road	3	1,264	56
915 A	Maloney Road	2	1,137	56
B	Maloney Road	2	1,137	56
C	Maloney Road	2	1,137	56
D	Maloney Road	2	1,137	56
E	Maloney Road	2	1,137	56
916 A	Maloney Road	3/B	1,264	56
	Maloney Road	3/B	1,264	56



Bldg No.	Location	Bed- rooms	Sq Ft	Year
916	B Maloney Road	3	1,264	56
	C Maloney Road	3	1,264	56
916	D Maloney Road	3	1,264	56
	E Maloney Road	3	1,264	56
	F Maloney Road	3/B	1,264	56
917	A Maloney Road	3/B	1,264	56
	B Maloney Road	2	1,137	56
	C Maloney Road	2	1,137	56
	D Maloney Road	2	1,137	56
	E Maloney Road	2	1,137	56
918	A Maloney Road	2/B	1,264	56
	B Maloney Road	2	1,264	56
	C Maloney Road	2	1,264	56
	D Maloney Road	2	1,264	56
	E Maloney Road	3	1,264	56
919	A Moyer Road	3/B	1,264	56
	B Maloney Road	2	1,137	56
	C Maloney Road	2	1,137	56
	D Maloney Road	2	1,137	56
	E Maloney Road	2	1,137	56
	F Maloney Road	3	1,264	56
	G Maloney Road	3	1,264	56
	H Maloney Road	3	1,264	56
	I Maloney Road	3	1,264	56
920	A Maloney Road	3/B	1,264	56
	B Maloney Road	3	1,264	56
	C Maloney Road	3	1,264	56
	D Maloney Road	3	1,264	56
	E Maloney Road	3	1,264	56
	F Maloney Road	3/B	1,264	56
921	A Maloney Road	3/B	1,264	56
	B Maloney Road	3	1,264	56
	C Maloney Road	3	1,264	56
	D Maloney Road	3	1,264	56
	E Maloney Road	3	1,264	56
922	A Maloney Road	3	1,264	56
	B Maloney Road	3	1,264	56
	C Maloney Road	3	1,264	56
	D Maloney Road	3	1,264	56
	E Maloney Road	2	1,137	56
	F Maloney Road	2	1,137	56
	G Maloney Road	2	1,137	56
	H Maloney Road	2	1,137	56
923	A Maloney Road	3	1,264	56
	B Maloney Road	3	1,264	56
	C Maloney Road	3	1,264	56
	D Maloney Road	3	1,264	56
	E Maloney Road	3/B	1,264	56
924	A Maloney Road	2	1,137	56
	B Maloney Road	2	1,137	56
	C Maloney Road	2	1,137	56

Bldg No.	Location	Bed-rooms	Sq Ft	Year
924 D	Maloney Road	2	1,137	56
E	Maloney Road	3/B	1,264	56
925 A	Maloney Road	3	1,264	56
B	Maloney Road	3	1,264	56
C	Maloney Road	3	1,264	56
D	Maloney Road	3	1,264	56
E	Maloney Road	3/B	1,264	56
926 A	Maloney Road	3/B	1,264	56
B	Maloney Road	2	1,137	56
C	Maloney Road	2	1,137	56
D	Maloney Road	2	1,137	56
E	Maloney Road	2	1,137	56
F	Maloney Road	3/B	1,264	56
927 A	Maloney Road	3/B	1,264	56
B	Maloney Road	3	1,264	56
C	Maloney Road	3	1,264	56
D	Maloney Road	3	1,264	56
E	Maloney Road	3	1,264	56
928 A	Fenner Road	3	1,264	56
B	Fenner Road	3	1,264	56
C	Fenner Road	3	1,264	56
D	Fenner Road	3	1,264	56
E	Fenner Road	2	1,137	56
F	Maloney Road	2	1,137	56
G	Maloney Road	2	1,137	56
H	Maloney Road	2	1,137	56
929 A	Maloney Road	3/B	1,264	56
B	Fenner Road	3	1,264	56
C	Fenner Road	3	1,264	56
D	Fenner Road	3	1,264	56
E	Fenner Road	3	1,264	56
930 A	Fenner Road	3	1,264	56
B	Fenner Road	3	1,264	56
C	Fenner Road	3	1,264	56
D	Fenner Road	3	1,264	56
E	Fenner Road	3/B	1,264	56
931 A	Fenner Road	3	1,264	56
B	Fenner Road	3	1,264	56
C	Fenner Road	3	1,264	56
D	Fenner Road	3	1,264	56
E	Fenner Road	3/B	1,264	56
932 A	Fenner Road	3/B	1,264	56
B	Fenner Road	3	1,264	56
C	Fenner Road	3	1,264	56
D	Fenner Road	3	1,264	56
E	Fenner Road	3	1,264	56
933 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	2	1,137	56

Bldg No.	Location	Bed-rooms	Sq Ft	Year
933 F	Barlow Road	2	1,137	56
G	Barlow Road	2	1,137	56
933 H	Barlow Road	2	1,137	56
I	Barlow Road	3/B	1,264	56
934 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	2	1,137	56
F	Barlow Road	2	1,137	56
G	Barlow Road	2	1,137	56
H	Barlow Road	2	1,137	56
I	Barlow Road	3/B	1,264	56
935 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
F	Barlow Road	3/B	1,264	56
936 A	Barlow Road	3/B	1,264	56
B	Barlow Road	2	1,137	56
C	Barlow Road	2	1,137	56
D	Barlow Road	3	1,137	56
E	Barlow Road	2	1,137	56
F	Barlow Road	3	1,264	56
G	Barlow Road	3	1,264	56
H	Barlow Road	3	1,264	56
I	Barlow Road	3	1,264	56
937 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3/B	1,264	56
938 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	2	1,189	56
F	Barlow Road	2	1,189	56
G	Barlow Road	2	1,189	56
H	Barlow Road	2	1,189	56
I	Barlow Road	3/B	1,264	56
939 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
F	Barlow Road	3/B	1,264	56
940 A	Barlow Road	3/B	1,264	56
B	Barlow Road	2	1,137	56
C	Barlow Road	2	1,137	56

Bldg No.	Location	Bed- rooms	Sq Ft	Year
940 D	Barlow Road	2	1,137	56
E	Barlow Road	2	1,137	56
940 F	Barlow Road	3	1,264	56
G	Barlow Road	3	1,264	56
H	Barlow Road	3	1,264	56
I	Barlow Road	3	1,264	56
941 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
942 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3/B	1,264	56
943 A	Barlow Road	3/B	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3	1,264	56
944 A	Barlow Road	3	1,264	56
B	Barlow Road	3	1,264	56
C	Barlow Road	3	1,264	56
D	Barlow Road	3	1,264	56
E	Barlow Road	3/B	1,264	56

900 AREA (DOGUE CREEK)

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# DESIGN PARAMETERS, SHGs

Location : Fort Belvoir, Virginia  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

01-08-91  
 6100190202  
 Page 1 of 1

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## DESIGN WEATHER PARAMETERS

City Name.....: Fort Belvoir  
 Location.....: Virginia  
 Latitude.....: 38.7 deg  
 Elevation.....: 69.0 ft  
 Summer Design Dry Bulb Temp.....: 90.0 F  
 Summer Design Wet Bulb Temp.....: 75.0 F  
 Daily Temperature Range.....: 23.0 F  
 Winter Design Dry Bulb Temp.....: 12.0 F  
 Atmospheric Clearness Number.....: 1.00

TABLE 1. MAXIMUM SOLAR HEAT GAINS - AVERAGE DAYS  
 (BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	24.2	61.9	98.8	111.9	98.8	61.9	24.2	24.2	80.1
Feb	31.7	75.4	106.8	115.1	106.8	75.4	31.7	31.7	107.3
Mar	40.7	87.4	107.7	108.9	107.7	87.4	40.7	40.7	136.8
Apr	59.9	97.6	104.8	97.9	104.8	97.6	59.9	49.2	164.2
May	74.7	103.1	98.7	84.7	98.7	103.1	74.7	54.9	181.6
Jun	84.9	109.2	97.9	79.8	97.9	109.2	84.9	57.8	194.9
Jul	80.4	106.6	98.5	82.0	98.5	106.6	80.4	56.4	189.0
Aug	69.0	104.2	106.2	95.1	106.2	104.2	69.0	52.1	177.5
Sep	52.3	99.7	115.4	112.4	115.4	99.7	52.3	45.3	158.1
Oct	36.3	88.9	118.8	124.1	118.8	88.9	36.3	36.3	128.3
Nov	26.6	67.2	103.2	114.9	103.2	67.2	26.6	26.6	89.5
Dec	21.3	53.7	89.1	102.7	89.1	53.7	21.3	21.3	68.5

TABLE 2. MAXIMUM SOLAR HEAT GAINS - DESIGN DAYS  
 (BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	20.2	157.9	243.4	253.9	243.4	157.9	20.2	20.2	140.3
Feb	52.5	188.6	246.3	238.2	246.3	188.6	52.5	24.6	186.3
Mar	95.5	219.4	234.8	201.8	234.8	219.4	95.5	29.3	227.8
Apr	141.3	224.3	200.7	148.1	200.7	224.3	141.3	34.1	255.2
May	165.9	220.1	171.5	106.1	171.5	220.1	165.9	37.3	267.4
Jun	173.0	215.4	157.5	89.2	157.5	215.4	173.0	47.4	269.3
Jul	163.5	215.7	167.2	102.9	167.2	215.7	163.5	38.2	264.2
Aug	136.2	216.5	193.7	143.1	193.7	216.5	136.2	35.7	250.5
Sep	89.8	206.8	224.9	195.9	224.9	206.8	89.8	30.4	220.2
Oct	51.4	182.2	238.2	231.2	238.2	182.2	51.4	25.4	183.0
Nov	20.6	155.1	239.4	250.0	239.4	155.1	20.6	20.6	139.7
Dec	18.3	140.7	235.7	254.0	235.7	140.7	18.3	18.3	120.5

# ZONE DESCRIPTION

Zone Name : Dogue Creek typicals 05-01-91  
 Prepared By : E A C 6100190202  
 Carrier Hourly Analysis Program Page 1 of 2

## 1. ZONE NAME AND TYPE

Zone Name = Dogue Creek typicals  
 Job Name = Fort Belvoir  
 Zone Type = 1 (Normal Zone)

## 2. THERMOSTAT AND EQUIPMENT SCHEDULE

### COOLING EQUIPMENT

Occupied cooling thermostat setpoint = 75.0 F  
 Unoccupied cooling thermostat setpoint = 75.0 F  
 Starting hour of occupied period = 0  
 Number of hours in occupied period = 24

### HEATING EQUIPMENT

Heating thermostat setpoint = 68.0 F

## 3. COOLING SYSTEM PARAMETERS

### SUPPLY AIR

Type of input = 3 (Supply Temperature)  
 Supply temperature = 55.0 F

### VENTILATION AIR

Type of input = 3 (% of supply)  
 Ventilation air = 0 %

### SAFETY FACTOR

Cooling safety factor = 10 %

## 4. HEATING SYSTEM PARAMETERS

### HEATING SOURCE

Type of system = 1 (Warm Air)  
 Supply temperature = 110.0 F

### VENTILATION AIR

Type of input = 3 (% of supply)  
 Ventilation air = 0 %

### SAFETY FACTOR

Heating safety factor = 10 %

## 5. OTHER SYSTEM PARAMETERS

### SUPPLY FAN

Total static pressure = 0.35 in wg  
 Total efficiency = 60 %  
 Fan configuration = 1 (Draw-Thru)

### EXHAUST AIR

Direct exhaust air flow rate = 0 % of vent. air

### RETURN AIR

Is a return plenum used = N

### COIL DATA

Cooling coil bypass factor = 0.050

STATE	Station	LOCATION		WINTER DESIGN DATA HEATING		DEGREE DAYS	SUMMER DESIGN DATA AIR CONDITIONING										SUMMER CRITERIA D. AIR CONDITIONING	
							Dry Bulb					Wet Bulb						
		Lat	Long	Elev	feet	Heating	99%	97%	95%	Pvlg	Mean	1% MCWB	2.5% MCWB	5% MCWB	Pvlg	1% 2.5% 5%	Dry Bulb	Wet Bulb
						annual	°F	°F	°F	dir	dir	°F	°F	°F	dir	°F	hrs	hrs
UTAH (CONT)																		
	Ogden MAP	N 41 12	W 112 01	4455		6012	1	5	S	6	SW	93 63	91 61	88 61	SW	66 65 64	37	727
	Provo	N 40 13	W 111 43	4448		5720	1	6	SE	5	SW	98 62	96 62	94 61	SW	66 65 64	185	989
	Salt Lake City IAP	N 40 46	W 111 58	4220		5983	3	8	SSE	6	SW	97 62	95 62	92 61	SW	66 65 64	139	932
	Tooele Army Depot	N 40 31	W 112 25	4700		5941	4	7	SE	4	N	93 61	91 61	88 60	N	65 64 63	41	704
	Utah Army Depot	N 41 15	W 112 00	4270		6012	2	6	S	6	SW	94 63	92 61	89 61	SW	66 65 64	59	849
	Wendover AF Range	N 40 44	W 114 02	4237		5673	8	12	ENE	4	E	97 60	95 59	93 59	E	65 64 62	158	1144
VERMONT																		
	Burlington IAP	N 44 28	W 73 09	332		7876	-12	-7	E	7	SSW	88 72	85 70	82 69	SSW	74 72 71	4	263
	St Albans AFS	N 44 46	W 73 03	1310		8790	-17	-11	E	9	SSW	85 70	82 68	79 67	SSW	72 70 69	1	119
VIRGINIA																		
	Arlington Hall	N 38 52	W 77 06	200		4211	13	17	WNW	11	S	94 75	91 74	89 74	S	78 77 76	55	815
	Bedford AFS	N 37 31	W 79 30	4220		7382	-3	1	NW	9	SW	82 66	80 66	77 65	SW	68 67 66	0	87
	Cameron Station	N 38 48	W 77 07	60		4211	13	17	WNW	11	S	94 75	91 74	89 74	S	78 77 76	55	815
	Camp A P Hill	N 38 08	W 77 21	230		4398	10	14	NW	6	S	96 77	93 76	90 75	S	80 78 77	90	897
	Camp Pickett/Blackstone AAF	N 37 05	W 77 57	390		3841	15	19	NW	6	SW	95 77	92 76	90 76	SW	79 78 77	66	905
	Cape Charles AFS	N 37 08	W 75 57	13		3474	20	23	N	11	SW	90 77	88 76	86 75	SW	79 78 77	0	596
	Charlottesville	N 38 02	W 78 31	870		4162	14	18	NE	7	SW	94 74	91 74	88 73	SW	77 76 75	54	964
	Dahlgren NAVSURFWPNCEN	N 38 20	W 77 02	21		4498	10	14	NW	6	S	93 77	91 76	89 75	S	80 78 77	39	892
	Dam Neck	N 36 47	W 75 57	10		3639	19	22	N	11	SW	91 77	89 76	87 75	SW	79 78 77	12	708
	Dulles IAP	N 38 57	W 77 27	313		5010	7	11	NW	9	S	93 74	90 73	88 73	S	77 76 75	28	749
	Fort Belvoir/Davison AAF	N 38 43	W 77 11	69		4891	8	12	NW	9	S	92 76	90 75	88 74	S	78 77 76	23	781
	Fort Eustis/Felker AAF	N 37 08	W 76 37	17		3752	17	20	N	10	SSW	92 77	90 76	88 75	SSW	78 77 76	26	875
	Fort Lee	N 37 14	W 77 21	145		3939	14	17	N	6	SW	95 76	92 76	90 75	SW	79 78 77	70	932
	Fort Lee AFS	N 37 14	W 77 20	75		3939	14	17	N	6	SW	95 76	92 76	90 75	SW	79 78 77	70	932
	Fort Monroe	N 37 00	W 76 19	15		3623	17	20	NW	9	SW	92 78	90 77	87 76	SW	79 78 77	21	809
	Fort Myer	N 38 53	W 77 05	220		4211	14	17	WNW	11	S	93 75	91 74	89 74	S	78 77 76	41	910
	Fort Story	N 36 56	W 76 00	13		3639	19	22	N	11	SW	91 77	89 76	87 75	SW	79 78 77	12	708
	Langley AFB/Hampton	N 37 05	W 76 21	10		3623	17	20	NW	9	SW	92 78	90 77	89 76	SW	79 78 77	21	809
	Little Creek NAVPHIBASE	N 36 54	W 76 09	15		3488	20	22	NW	10	SW	93 77	91 76	89 76	SW	79 78 77	41	874
	Lynchburg MAP	N 37 20	W 79 12	916		4233	12	16	NE	7	SW	93 74	90 74	88 73	SW	77 76 75	31	696
	Manassas/Davis Field	N 38 43	W 77 31	186		4398	10	14	NW	6	S	96 76	93 75	90 74	S	78 77 76	90	897
	Newport News/Patrick Henry	N 37 08	W 76 30	41		3549	17	20	NW	9	SW	92 78	90 77	87 76	SW	79 78 77	21	809
	Norfolk	N 36 54	W 76 12	22		3488	20	22	NW	10	SW	93 77	91 76	89 76	SW	79 78 77	41	874



U-VALUE CALCULATION FORM

FOR WALL/PARTITION

Project: DOGUE CREEK VILLAGE, FORT BELVOIR

EAC Project Number: 89034.01 Date: AUGUST 1990 By: JB

☒ Wall

☐ Partition

Material	Resistance (h-ft <sup>2</sup> - F/Btu)	
	Summer	Winter
1. <u>Outside Air</u>	<u>0.25</u>	<u>0.17</u>
2. <u>Inside Still Air</u>	<u>0.68</u>	<u>0.68</u>
3. <u>4" FACE BRICK</u>		<u>0.44</u>
4. <u>4" CINDER BLOCK</u>		<u>1.11</u>
5. <u>PLASTER</u>		<u>0.45</u>
6. _____		
7. _____		
8. _____		
Total (R) =		<u>2.85</u>
U = 1/R =		<u>0.351</u>

(Btu/h-sq.ft. - F)

MATERIAL	R*	MATERIAL	R*
Air Space 3/4" (90 F)	0.84	Blanket/Batt Insul.	
Air Space 3/4" (0 F)	1.18	2-2 3/4 in.	7.00
Still Air	0.68	3-4 in.	11.00
Moving Air 7 1/2 MPH	0.25	3.5 in.	13.00
Moving Air 15 MPH	0.17	5.5-6.5 in.	19.00
Face Brick 4"	0.44	6-7.5 in.	22.00
Cinderblock 4"	1.11	9-10 in.	30.00
Cinderblock 8"	1.72	12-13 in.	38.00
Cinderblock 12"	1.89	Rigid Insul. 1"	2.78
Gypsum Bd 3/8"	0.32	Styrofoam 1"	4.00
Gypsum Bd 1/2"	0.45	Vermiculite 1"	2.27
Gypsum Plaster 1/2"	0.45	Vapor Barr.-felt	0.06
Sand Plaster 3/8"	0.08	Fir, Pine & Simil.	
Loose Fill Sandust 1"	2.22	Woods 3/4"	0.94
Perlite Expanded 1"	2.90		

\*(h-sq.ft. - F/Btu)

U-VALUE CALCULATION FORM

FOR ROOF/FLOOR

Project: DOGUE CREEK VILLAGE, FORT BELVOIR

EAC Project Number: 89034.01 Date: AUGUST 1990 By: JB

☒ Roof

☐ Floor

Material	Resistance (h-sq. ft.-F/Btu)	
	Summer	Winter
1. <u>Top Surface (Moving Air)</u>	<u>0.25</u>	<u>0.61</u>
2. <u>Bottom Surface (Still Air)</u>		<u>0.61</u>
3. <u>INSULATION</u>		<u>30.00</u>
4. <u>PLASTER</u>		<u>0.45</u>
5. _____		
6. _____		
7. _____		
8. _____		
Total (R) =		<u>31.67</u>
U = 1/R =		<u>0.032</u>

(Btu/h-sq.ft. - F)

MATERIAL	DIRECTION OF HEAT FLOW	R*	MATERIAL	R*
Air Space 3/4" (0 F)	UP	0.93	Batt/Blanket	
Air Space 4"	UP	1.03	2-2 3/4 in.	7.00
Air Space 3/4" (90 F)	DN	0.85	3-4 in.	11.00
Air Space 4"	DN	1.00	3.5 in.	13.00
Still Air	UP	0.61	5.5-6.5 in.	19.00
Still Air	DN	0.92	6-7.5 in.	22.00
Moving Air 7 1/2 MPH	ANY	0.25	9-10 in.	30.00
Moving Air 15 MPH	ANY	0.17	12-13 in.	38.00
Acoustical Tile 1/2"		1.25	Rigid Insul. 1"	2.78
Acoustical Tile 3/4"		1.89	Stryofoam 1"	4.00
Sand Plaster 3/8"		0.08	Built-up Roof 3/8"	0.33
Gypsum Plaster 1/2"		0.45	Asphalt Shingles	0.44

\*(h-sq.ft. - F/Btu)

ENGINEERING ANALYSIS

Sheet 1 of 1

By: TB

Calculations for Infiltration

DOGUE CREEK - Typical  
~~Building~~

Project: ESOS, Fort Belvoir Date: August, 1990

Contract No: DACA-31-89-C-0189 EAC Project No.: 89034.01

Calculations based on ASHRAE 1989 Page F 23.14.

Building Leakage Area

	Effective Leakage Area, in <sup>2</sup>	Building Component Parameter	Building Leakage Area D <sub>L</sub> , in <sup>2</sup>
	L <sub>L</sub>	D <sub>L</sub>	L
Sill foundation	0.19/ft. of perimeter	250 ft.	48
Joints, ceiling/wall	0.12/ft. of wall	250 ft.	30
Windows	0.063/ft <sup>2</sup> . of window	830 ft <sup>2</sup> .	52
Doors	0.215/ft <sup>2</sup> . of doors	152 ft <sup>2</sup> .	40
Wall - Window frames	0.15/ft <sup>2</sup> . of window	830 ft <sup>2</sup> .	125
- Door frames	0.072/ft <sup>2</sup> . of door	190 ft <sup>2</sup> .	14
Elec. outlet/switch	0.16/ <del>switch</del> outlet	200 <del>switch</del>	32
Recessed lights	1.6/fixture	10 <del>fix</del>	16
Pipe penetration	0.15 <del>1.55</del> /in <sup>2</sup> . of pipe	10 <del>fix</del>	2
Exhaust Fans	6.0/fan	10 <del>fix</del>	60
Duct penetration	2.2/SF	10SF	22
Furnace	5 <del>10</del> <del>fix</del>	5	22
			<u>466</u>

$$\begin{aligned} \text{Infiltration } Q(\text{cfm}) &= L \times (A \Delta t + B v^2)^{1/2} \\ &= L(0.03/3 \times 51 + 0.0057 \times 14^2)^{1/2} \\ &= L \times 2.2 = 466 \times 2.2 = 1025 \text{ CFM} \end{aligned}$$

$$\begin{aligned} \text{Infiltration through walls} &= 0.1 \times 4750 (\text{SF}) \\ &= 475 \text{ CFM} \end{aligned}$$

$$\text{Total Infiltration} = 1025 + 475 = 1500 \text{ CFM}$$

$$\begin{aligned} \text{Infiltration Rate} &= \frac{1500}{6800} = 0.22 = \underline{\underline{0.2}} \text{ CFM/SF} \end{aligned}$$

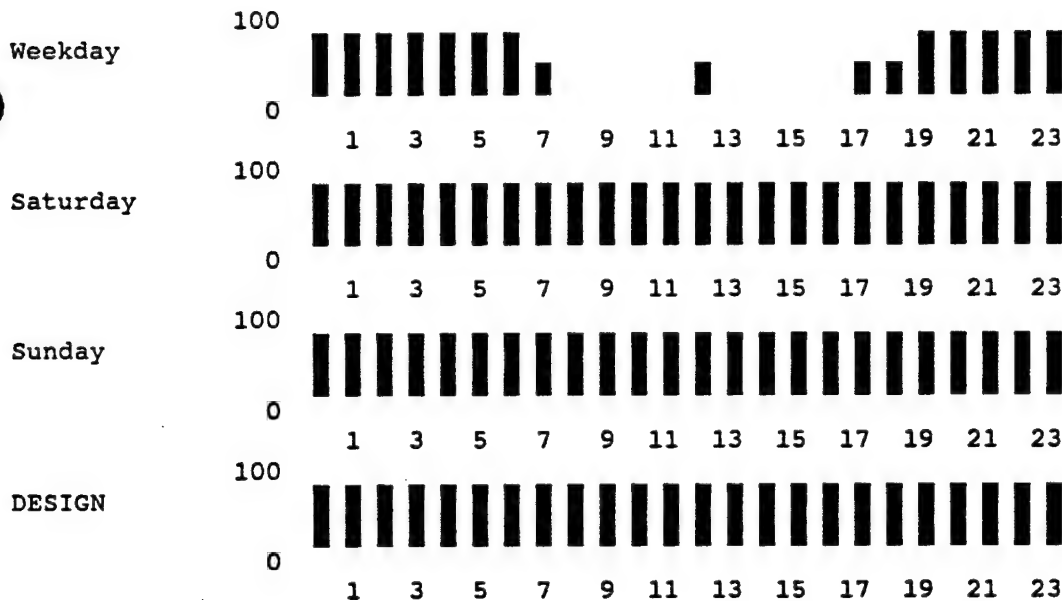
92  
(ASHRAE 1989, p. 23.13)

MASTER SCHEDULE DISPLAY - 1. OCCUPANCY

Weekday		Saturday		Sunday		DESIGN	
Pct	Hr Pct	Hr Pct	Hr Pct	Hr Pct	Hr Pct	Hr Pct	Hr Pct
0)	100	12)	50	0)	100	12)	100
1)	100	13)	30	1)	100	13)	100
2)	100	14)	30	2)	100	14)	100
3)	100	15)	30	3)	100	15)	100
4)	100	16)	30	4)	100	16)	100
5)	100	17)	50	5)	100	17)	100
6)	100	18)	70	6)	100	18)	100
7)	50	19)	100	7)	100	19)	100
8)	30	20)	100	8)	100	20)	100
9)	30	21)	100	9)	100	21)	100
10)	30	22)	100	10)	100	22)	100
11)	30	23)	100	11)	100	23)	100

Press <ENTER> to continue.

MASTER SCHEDULE DISPLAY - 1. OCCUPANCY



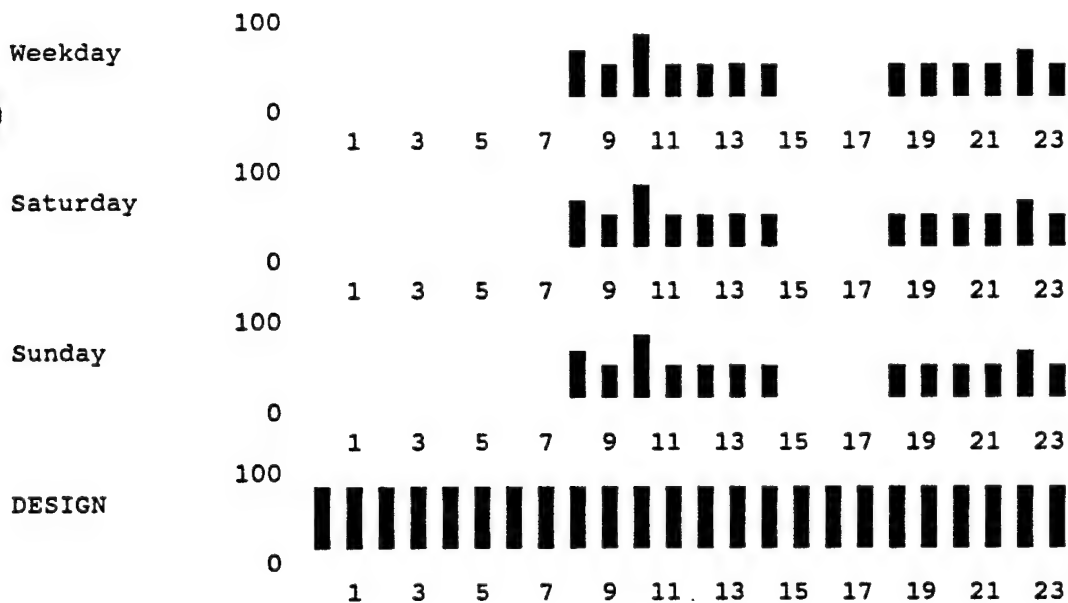
Press <ENTER> to continue.

# MASTER SCHEDULE DISPLAY - 2. HOT WATER

Weekday				Saturday				Sunday				DESIGN			
Hr Pct		Hr Pct		Hr Pct		Hr Pct		Hr Pct		Hr Pct		Hr Pct		Hr Pct	
0)	10	12)	60	0)	10	12)	60	0)	10	12)	60	0)	100	12)	100
1)	3	13)	55	1)	3	13)	55	1)	3	13)	55	1)	100	13)	100
2)	1	14)	50	2)	1	14)	50	2)	1	14)	50	2)	100	14)	100
3)	1	15)	45	3)	1	15)	45	3)	1	15)	45	3)	100	15)	100
4)	1	16)	40	4)	1	16)	40	4)	1	16)	40	4)	100	16)	100
5)	1	17)	45	5)	1	17)	45	5)	1	17)	45	5)	100	17)	100
6)	3	18)	50	6)	3	18)	50	6)	3	18)	50	6)	100	18)	100
7)	15	19)	60	7)	15	19)	60	7)	15	19)	60	7)	100	19)	100
8)	65	20)	75	8)	65	20)	75	8)	65	20)	75	8)	100	20)	100
9)	70	21)	70	9)	70	21)	70	9)	70	21)	70	9)	100	21)	100
10)	85	22)	65	10)	85	22)	65	10)	85	22)	65	10)	100	22)	100
11)	70	23)	60	11)	70	23)	60	11)	70	23)	60	11)	100	23)	100

Press <ENTER> to continue.

## MASTER SCHEDULE DISPLAY - 2. HOT WATER



Press <ENTER> to continue.

*The chart shows that the hot water usage is highest during the day, peaking at 75% at hour 20. The design usage is constant at 100%.*

PROJECTED NAVFAC COST INDEX  
MONTHLY  
JULY 1989

YEAR	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1974	1156	1154	1155	1177	1177	1199	1233	1240	1238	1246	1239	1240
1975	1242	1265	1265	1269	1287	1307	1317	1330	1333	1351	1349	1354
1976	1362	1370	1378	1391	1398	1416	1425	1455	1467	1476	1479	1484
1977	1489	1499	1504	1506	1507	1521	1539	1554	1587	1617	1603	1606
1978	1609	1617	1620	1621	1652	1663	1696	1705	1720	1721	1732	1734
1979	1740	1740	1750	1749	1753	1809	1829	1849	1900	1899	1902	1909
1980	1895	1894	1915	1899	1888	1916	1950	1971	1976	1981	2000	2017
1981	2015	2016	2014	2064	2076	2083	2109	2118	2139	2156	2186	2184
1982	2184	2200	2195	2195	2220	2219	2233	2253	2249	2248	2260	2295
1983	2311	2348	2352	2347	2351	2388	2414	2428	2430	2416	2419	2406
1984	2402	2407	2412	2422	2419	2417	2418	2428	2430	2424	2421	2408
1985	2410	2414	2406	2405	2411	2429	2448	2442	2440	2441	2446	2439
1986	2440	2446	2447	2458	2479	2493	2499	2498	2504	2511	2511	2511
1987	2515	2510	2518	2523	2524	2525	2538	2557	2565	2569	2564	2589
1988	2574	2576	2586	2591	2592	2595	2598	2611	2612	2612	2616	2617
1989	2619	2613	2616	2620	2621	2626	2633	2640	2648	2655	2663	2670
1990	2677	2683	2690	2697	2704	2710	2717	2724	2731	2738	2744	2751
1991	2757	2763	2769	2776	2782	2788	2794	2800	2806	2812	2819	2825
1992	2830	2835	2840	2845	2850	2855	2861	2866	2871	2876	2881	2886
1993	2891	2896	2900	2905	2910	2914	2919	2924	2928	2933	2938	2942

ANNUAL MARK-UP FACTORS FOR ESCALATION  
(BEYOND FY 93, USE 1.80% ESCALATION COMPOUNDED EACH YEAR)

FISCAL-YEAR	4-87	4-88	4-89	4-90	4-91	4-92	4-93	4-94	4-95
4-83	1.07	1.10	1.12	1.15	1.18	1.21	1.24	1.26	1.28
4-84	1.04	1.07	1.08	1.11	1.15	1.17	1.20	1.22	1.24
4-85	1.05	1.08	1.09	1.12	1.15	1.18	1.21	1.23	1.25
4-86	1.03	1.05	1.07	1.10	1.13	1.16	1.18	1.20	1.22
4-87	1.00	1.03	1.04	1.07	1.10	1.13	1.15	1.17	1.19
4-88	0.97	1.00	1.01	1.04	1.07	1.10	1.12	1.14	1.16
4-89	0.96	0.99	1.00	1.03	1.06	1.09	1.11	1.13	1.15
4-90	0.94	0.96	0.97	1.00	1.03	1.05	1.08	1.10	1.12
4-91	0.91	0.93	0.94	0.97	1.00	1.02	1.05	1.07	1.08
4-92	0.89	0.91	0.92	0.95	0.98	1.00	1.02	1.04	1.06
4-93	0.87	0.89	0.90	0.93	0.96	0.98	1.00	1.02	1.04

NOTE: Escalation rate change to be 1.80% after 1993.

Figure 9  
Projected NAVFAC Cost Index

## STUDY PARAMETER INPUT PRINTOUT

Prepared By : E A C  
Advanced Engineering Economic Analysis Program

05-01-91  
60901891.00  
Page 1 of 1

\*\*\*\*\*  
STUDY CRITERIA

-----  
ECIP - FEMP/10CFR436A (Army TM 5-802-1, Para. 2-3&4)  
-----

Discount Rate	:	7.0 %
Investment Credit	:	10.0 %
Payment Time	:	1.0 (1 = end of year)

-----

\*\*\*\*\*  
KEY STUDY DATES

-----  
ECIP Economic Life : 15 (years)  
-----

\*\*\*\*\*  
ENERGY RELATED STUDY PARAMETERS

State	:	VA
Prices of Electricity	:	18.05
Distillate Oil	:	7.43
Residual Oil	:	6.62
Natural Gas	:	5.33
Coal	:	0.00

-----

Prices are specified in \$ / Million BTU, FEMP Date (JUL 1988)  
-----

\*\*\*\*\*  
STUDY IDENTIFICATION BLOCK

Project Title	:	FORT BELVOIR E.S.O.S
Installation Name	:	DOGUE CREEK VILLAGE
Project Number	:	DACA-31-89-C-0198
Fiscal Year	:	1991
Name of Analyst	:	E A C, P.C. Burke, Va.

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\*\*\*\*\*

# ZONE DESCRIPTION

Zone Name : Dogue Creek Village  
 Prepared By : E A C, PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## \*\*\*\*\* 6. SPACES INCLUDED IN ZONE

Space Name	Qty.	Space Name	Qty.
1 DOGUE CREEK, type 1 ex 1 x 1		6 DOGUE CREEK, type 2 ex 2 x 1	
2 DOGUE CREEK, type 1 ex 2 x 1		7 DOGUE CREEK, bungalow 1 x 1	
3 DOGUE CREEK, type 1 int. x 1		8 DOGUE CREEK, bungalow 2 x 1	
4 DOGUE CREEK, type 2 ex1 x 1		9 DOGUE CREEK, bungalow 3 x 1	
5 DOGUE CREEK, type 2 int. x 1		10 DOGUE CREEK, type 4 int. x 1	
*****			



## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 1 ex 1

02-05-91

Prepared By : E A C , PC BURKE, VA.

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Carrier Hourly Analysis Program

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	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = DOGUE CREEK, type 1 ex 1

Exposure :	E	W	Floor Area :	1,137.0 sqft
Wall Area :	288.0	262.0	Roof Area :	568.0 sqft
Glass Area :	62.0	86.0	Current	
			Elements :	Ms,Wl,Gr,Gl,In

\*\*\*\*\*  
ADDITIONAL ELEMENT - Misc. Internal-----  

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*  
ADDITIONAL ELEMENT - Wall-----  

Weight	=	M (lb/sqft)	Exposure	=	S
Color	=	M	Net Area	=	300.0 sqft
U-Value	=	0.351 BTU/hr/sqft/F			

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground-----  

Slab Floor Area	=	568.0 sqft
Perimeter	=	75.0 ft
Depth	=	0.0 ft

\*\*\*\*\*  
ADDITIONAL ELEMENT - Glass-----  

U-Value	=	0.550 BTU/hr/sqft/F	Exposure	=	S
Glass Factor	=	0.90	Area	=	22.5 sqft
Internal Shades	?	N			

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration-----  

Cooling	:	0.20 CFM/sqft	=	227 CFM
Heating	:	0.20 CFM/sqft	=	227 CFM
Typical	:	0.20 CFM/sqft	=	227 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 1 ex 2

02-05-91

Prepared By : E A C , PC BURKE, VA.

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades ?	N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

SPACE NAME = DOGUE CREEK, type 1 ex 2

Exposure :	E	W	Floor Area :	1,137.0 sqft
Wall Area :	288.0	262.0	Roof Area :	568.0 sqft
Glass Area :	62.0	86.0	Current Elements :	Ms,Wl,Gr,Gl,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Misc. Internal

Sensible Load = 1,200 BTU/hr  
 Latent Load = 0 BTU/hr  
 Schedule = 1

\*\*\*\*\*

ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	380.0 sqft
U-Value =	0.351 BTU/hr/sqft/F		

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area = 568.0 sqft  
 Perimeter = 75.0 ft  
 Depth = 0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	44.5 sqft
Internal Shades ?	N		

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling :	0.20 CFM/sqft =	227 CFM
Heating :	0.20 CFM/sqft =	227 CFM
Typical :	0.20 CFM/sqft =	227 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 1 int.

02-05-91

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Carrier Hourly Analysis Program

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U-Value :	Walls	Roof	Glass	Building Weight	:	M
Weight :	M	M	0.550	Glass Factor	:	0.90
Color :	M	M		Internal Shades	?	N

People :	sqft/person	=	400.0	Schedule	=	1	Activity Level	=	1
Lights :	W/sqft	=	0.00	Schedule	=	2	Wattage Mult.	=	1.00
	: Fixture Type	=	3	Free-hanging					

-----  
SPACE NAME = DOGUE CREEK, type 1 int.

Exposure :	E	W	Floor Area :	1,137.0 sqft
Wall Area :	288.0	262.0	Roof Area :	568.0 sqft
Glass Area :	62.0	86.0	Current	
			Elements	: Ms,Gr,In

\*\*\*\*\*  
ADDITIONAL ELEMENT - Misc. Internal

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	568.0 sqft
Perimeter	=	40.0 ft
Depth	=	0.0 ft

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration

Cooling	:	0.20 CFM/sqft	=	227 CFM
Heating	:	0.20 CFM/sqft	=	227 CFM
Typical	:	0.20 CFM/sqft	=	227 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 2 ex1

02-05-91

Prepared By : E A C , PC BURKE, VA.

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	? N

People : sqft/person = 400.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 2    Wattage Mult. = 1.00  
 : Fixture Type = 3    Free-hanging

-----  
SPACE NAME = DOGUE CREEK, type 2 ex1

Exposure :	E	W	Floor Area :	1,264.0 sqft
Wall Area :	330.0	304.0	Roof Area :	632.0 sqft
Glass Area :	62.0	86.0	Current Elements :	G1,W1,Ms,Gr,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value	=	0.550 BTU/hr/sqft/F	Exposure	=	S
Glass Factor	=	0.90	Area	=	44.5 sqft
Internal Shades	?	N			

\*\*\*\*\*

ADDITIONAL ELEMENT - Wall

Weight	=	M (lb/sqft)	Exposure	=	S
Color	=	M	Net Area	=	456.0 sqft
U-Value	=	0.351 BTU/hr/sqft/F			

\*\*\*\*\*

ADDITIONAL ELEMENT - Misc. Internal

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	632.0 sqft
Perimeter	=	85.0 ft
Depth	=	0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling	:	0.20 CFM/sqft	=	253 CFM
Heating	:	0.20 CFM/sqft	=	253 CFM
Typical	:	0.20 CFM/sqft	=	253 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 2 int.

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = DOGUE CREEK, type 2 int.

Exposure :	E	W	Floor Area :	1,264.0 sqft
Wall Area :	330.0	304.0	Roof Area :	632.0 sqft
Glass Area :	62.0	86.0	Current Elements :	Ms,Gr,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Misc. Internal

Sensible Load = 1,200 BTU/hr  
 Latent Load = 0 BTU/hr  
 Schedule = 1

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area = 632.0 sqft  
 Perimeter = 48.0 ft  
 Depth = 0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling : 0.20 CFM/sqft = 253 CFM  
 Heating : 0.20 CFM/sqft = 253 CFM  
 Typical : 0.20 CFM/sqft = 253 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 2 ex 2

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	N

People : sqft/person = 400.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 2    Wattage Mult. = 1.00  
 : Fixture Type = 3    Free-hanging

-----  
SPACE NAME = DOGUE CREEK, type 2 ex 2

Exposure :	E	W	Floor Area :	1,264.0 sqft
Wall Area :	330.0	304.0	Roof Area :	632.0 sqft
Glass Area :	62.0	86.0	Current Elements :	Gl,Wl,Ms,Gr,In

\*\*\*\*\*  
ADDITIONAL ELEMENT - Glass

U-Value	=	0.550 BTU/hr/sqft/F	Exposure	=	S
Glass Factor	=	0.90	Area	=	22.2 sqft
Internal Shades	?	N			

\*\*\*\*\*  
ADDITIONAL ELEMENT - Wall

Weight	=	M (lb/sqft)	Exposure	=	S
Color	=	M	Net Area	=	380.0 sqft
U-Value	=	0.351 BTU/hr/sqft/F			

\*\*\*\*\*  
ADDITIONAL ELEMENT - Misc. Internal

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	632.0 sqft
Perimeter	=	85.0 ft
Depth	=	0.0 ft

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration

Cooling	:	0.20 CFM/sqft	=	253 CFM
Heating	:	0.20 CFM/sqft	=	253 CFM
Typical	:	0.20 CFM/sqft	=	253 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, bungalow 1

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight	: M
Weight :	M	M		Glass Factor	: 0.90
Color :	M	M		Internal Shades	? N

People : sqft/person = 400.0    Schedule = 1    Activity Level = 1  
 Lights : W/sqft = 0.00    Schedule = 2    Wattage Mult. = 1.00  
       : Fixture Type = 3 Free-hanging

SPACE NAME = DOGUE CREEK, bungalow 1

Exposure :	S	N	Floor Area :	1,264.0 sqft
Wall Area :	295.0	162.0	Roof Area :	1,264.0 sqft
Glass Area :	49.5	40.2	Current Elements :	G1,W1,Ms,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value	=	0.550 BTU/hr/sqft/F	Exposure	=	E
Glass Factor	=	0.90	Area	=	21.6 sqft
Internal Shades	?	N			

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight	=	M (lb/sqft)	Exposure	=	W
Color	=	M	Net Area	=	262.0 sqft
U-Value	=	0.351 BTU/hr/sqft/F			

\*\*\*\*\*

## ADDITIONAL ELEMENT - Misc. Internal

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	1,264.0 sqft
Perimeter	=	110.0 ft
Depth	=	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling	: 0.20 CFM/sqft =	253 CFM
Heating	: 0.20 CFM/sqft =	253 CFM
Typical	: 0.20 CFM/sqft =	253 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, bungalow 2  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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\*\*\*\*\*  
 U-Value : Walls 0.351 Roof 0.032 Glass 0.550 Building Weight : M  
 Weight : M M Glass Factor : 0.90  
 Color : M M Internal Shades ? N  
 People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging  
 -----

SPACE NAME = DOGUE CREEK, bungalow 2

Exposure : S N Floor Area : 1,264.0 sqft  
 Wall Area : 295.0 104.0 Roof Area : 1,264.0 sqft  
 Glass Area : 49.5 40.2 Current  
 Elements : Gl,Wl,Ms,Gr,In  
 \*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value = 0.550 BTU/hr/sqft/F Exposure = E  
 Glass Factor = 0.90 Area = 43.2 sqft  
 Internal Shades ? N  
 -----

\*\*\*\*\*  
ADDITIONAL ELEMENT - Wall

Weight = M (lb/sqft) Exposure = E  
 Color = M Net Area = 400.0 sqft  
 U-Value = 0.351 BTU/hr/sqft/F  
 -----

\*\*\*\*\*  
ADDITIONAL ELEMENT - Misc. Internal

Sensible Load = 1,200 BTU/hr  
 Latent Load = 0 BTU/hr  
 Schedule = 1  
 -----

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground

Slab Floor Area = 1,264.0 sqft  
 Perimeter = 120.0 ft  
 Depth = 0.0 ft  
 -----

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration

Cooling : 0.20 CFM/sqft = 253 CFM  
 Heating : 0.20 CFM/sqft = 253 CFM  
 Typical : 0.20 CFM/sqft = 253 CFM  
 -----

\*\*\*\*\*



## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, bungalow 3

02-05-91

Prepared By : E A C , PC BURKE, VA.

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	? N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = DOGUE CREEK, bungalow 3

Exposure :	S	N	Floor Area :	1,137.0 sqft
Wall Area :	250.0	262.0	Roof Area :	1,137.0 sqft
Glass Area :	49.5	40.2	Current	
			Elements :	G1,W1,Ms,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value	=	0.550 BTU/hr/sqft/F	Exposure	=	E
Glass Factor	=	0.90	Area	=	21.6 sqft
Internal Shades	?	N			

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight	=	M (lb/sqft)	Exposure	=	W
Color	=	M	Net Area	=	262.0 sqft
U-Value	=	0.351 BTU/hr/sqft/F			

\*\*\*\*\*

## ADDITIONAL ELEMENT - Misc. Internal

Sensible Load	=	1,200 BTU/hr
Latent Load	=	0 BTU/hr
Schedule	=	1

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area	=	1,137.0 sqft
Perimeter	=	100.0 ft
Depth	=	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling	:	0.20 CFM/sqft	=	227 CFM
Heating	:	0.20 CFM/sqft	=	227 CFM
Typical	:	0.20 CFM/sqft	=	227 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : DOGUE CREEK, type 4 int

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Prepared By : E A C , PC BURKE, VA.

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Carrier Hourly Analysis Program

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\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.351	0.032	0.550	Building Weight	: M
Weight :	M	M		Glass Factor	: 0.90
Color :	M	M		Internal Shades	? N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = DOGUE CREEK, type 4 int

Exposure :	E	W	Floor Area :	1,189.0 sqft
Wall Area :	305.0	279.0	Roof Area :	643.0 sqft
Glass Area :	62.0	86.0	Current	
			Elements :	Ms,Gr,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Misc. Internal

Sensible Load = 1,200 BTU/hr  
 Latent Load = 0 BTU/hr  
 Schedule = 1

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area = 644.0 sqft  
 Perimeter = 45.0 ft  
 Depth = 0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling : 0.20 CFM/sqft = 238 CFM  
 Heating : 0.20 CFM/sqft = 238 CFM  
 Typical : 0.20 CFM/sqft = 238 CFM

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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 6100190202  
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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Dogue Creek unit 1 ex 1      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	16,708
ROOF TRANSMISSION	1,018
GLASS TRANSMISSION	5,251
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	13,719
SLAB FLOOR	2,719
HEATING SAFETY BTU/hr	3,941
SUB-TOTAL	43,356
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	43,356
HEATING SUPPLY CFM	958 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Dogue Creek unit 1 int 1 Calc Time: Winter design  
 Job Name : Fort Belvoir Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	10,811
ROOF TRANSMISSION	1,018
GLASS TRANSMISSION	4,558
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	13,719
SLAB FLOOR	1,543
HEATING SAFETY BTU/hr	3,165
SUB-TOTAL	34,813
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	34,813
HEATING SUPPLY CFM	769 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Dogue Creek unit 1 ex2      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	18,280
ROOF TRANSMISSION	1,018
GLASS TRANSMISSION	5,929
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	13,719
SLAB FLOOR	2,719
HEATING SAFETY BTU/hr	4,166
SUB-TOTAL	45,831
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	45,831
HEATING SUPPLY CFM	1,013 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Dogue Creek unit 2 ex 1      Calc Time: Winter design  
 Job Name : Fort Belvoir                      Amb db : 12.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	21,425
ROOF TRANSMISSION	1,133
GLASS TRANSMISSION	5,929
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	15,251
SLAB FLOOR	3,077
HEATING SAFETY BTU/hr	4,681
SUB-TOTAL	51,496
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	51,496
HEATING SUPPLY CFM	1,138 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
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## CALCULATION DATA:

Zone Name : Dogue Creek unit 2 int      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	12,462
ROOF TRANSMISSION	1,133
GLASS TRANSMISSION	4,558
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	15,251
SLAB FLOOR	1,834
HEATING SAFETY BTU/hr	3,524
SUB-TOTAL	38,761
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	38,761
HEATING SUPPLY CFM	857 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Dogue Creek unit 2 ex 2      Calc Time: Winter design  
 Job Name : Fort Belvoir                      Amb db : 12.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	19,931
ROOF TRANSMISSION	1,133
GLASS TRANSMISSION	5,242
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	15,251
SLAB FLOOR	3,077
HEATING SAFETY BTU/hr	4,463
SUB-TOTAL	49,097
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	49,097
HEATING SUPPLY CFM	1,085 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F



# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

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## \*\*\*\*\* CALCULATION DATA:

Zone Name : Dogue Creek unit 4  
 Job Name : Fort Belvoir

Calc Time: Winter design  
 Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	11,479
ROOF TRANSMISSION	1,152
GLASS TRANSMISSION	4,558
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	14,346
SLAB FLOOR	1,737
HEATING SAFETY BTU/hr	3,327
SUB-TOTAL	36,600
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	36,600
HEATING SUPPLY CFM	809 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

02-05-91  
 6100190202  
 Page 1 of 1

## CALCULATION DATA:

Zone Name : Dogue Creek bungalow 1      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	14,133
ROOF TRANSMISSION	2,265
GLASS TRANSMISSION	3,428
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	15,251
SLAB FLOOR	4,138
HEATING SAFETY BTU/hr	3,922
SUB-TOTAL	43,137
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	43,137
HEATING SUPPLY CFM	953 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

02-05-91  
 6100190202  
 Page 1 of 1

## CALCULATION DATA:

Zone Name : Dogue Creek bungalow 2      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	15,705
ROOF TRANSMISSION	2,265
GLASS TRANSMISSION	4,093
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	15,251
SLAB FLOOR	4,474
HEATING SAFETY BTU/hr	4,179
SUB-TOTAL	45,968
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	45,968
HEATING SUPPLY CFM	1,016 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia  
 Prepared By : E A C , PC BURKE, VA.  
 Carrier Hourly Analysis Program

02-05-91  
 6100190202  
 Page 1 of 1

## CALCULATION DATA:

Zone Name : Dogue Creek bungalow 3      Calc Time: Winter design  
 Job Name : Fort Belvoir      Amb db : 12.0 F

## LOAD COMPONENT

## LOAD (BTU/hr)

WALL TRANSMISSION	15,214
ROOF TRANSMISSION	2,038
GLASS TRANSMISSION	3,428
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	13,719
SLAB FLOOR	3,758
HEATING SAFETY BTU/hr	3,816

SUB-TOTAL	41,971
NET VENTILATION LOSS	0

TOTAL HEATING LOAD	41,971
--------------------	--------

HEATING SUPPLY CFM	928 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

# AIR SYSTEM DESCRIPTION

Name : Dogue Creek typical sys.

01-08-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C, PC BURKE, VA.

Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = Dogue Creek typical sys.  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
-----			
Weekday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Saturday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Sunday	: Occupied Period Begins at	0 ; Duration	= 24 hrs
Design Day	: Occupied Period Begins at	0 ; Duration	= 24 hrs

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
 Heating supply temperature = 110.0 F  
 Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 CFM  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Dogue Creek typical sys.

01-08-91

Carrier Hourly Analysis Program

6100190202

Prepared By : E A C, PC BURKE, VA.

Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved

Static = 0.35 in wg

Efficiency = 60 %

Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050

Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Fort Belvoir, Virginia

04-03-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building 900

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 12.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
DOGUE CREEK, type 1 ex 1 x	1	43,355.6	958.2
DOGUE CREEK, type 1 ex 2 x	1	45,830.7	1,012.9
DOGUE CREEK, type 1 int. x	2	34,813.2	769.4
DOGUE CREEK, bungalow 1 x	1	43,136.6	953.4

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Fort Belvoir, Virginia

04-03-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building 900

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 12.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	70,742
ROOF TRANSMISSION	6,337
GLASS TRANSMISSION	23,725
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	70,125
SLAB FLOOR	12,662
HEATING SAFETY BTU/hr	18,359
SUB-TOTAL	201,949
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	201,949
HEATING SUPPLY CFM	4,463 CFM
HEATING SUPPLY AIR TEMPERATURE	110.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*



# PLANT DESCRIPTIONS

Plant : Building 900 Oil  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

04-03-91  
 6100190202  
 Page 1 of 1

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
 Name = Building 900 Oil  
 Cooling Plant Type = User Defined  
 Heating Plant Type = Combustion

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Dogue Creek unit 1 ex 1	1	Dogue Creek unit 1 int	2
Dogue Creek unit 1 ex 2	1	Dogue Creek bungalow 1	1

## 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
 Nominal capacity = 0.00 Ton  
 Nominal input power rate = 0.000 kW/Ton  
 Type of cooling = DX  
 Condenser type = Air Cooled

### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90 -----	100	60 -----	100	30 -----	100
80 -----	100	50 -----	100	20 -----	100
70 -----	100	40 -----	100	10 -----	100

## 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 182.64 MBH  
 Fuel type = Fuel Oil  
 Rated plant output = 275.0 MBH  
 Type of heating = Direct  
 Is plant efficiency computer generated ? N  
 Seasonal plant efficiency = 78 %

## 4 PUMP SYSTEM DATA

(No inputs required)

# BUILDING DESCRIPTION

Building : Building 900 Oil

04-03-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 900 Oil

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW

Power schedule = 4

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y

Maximum hourly hot water use = 35.0 gal

Hot water schedule = 2

Average entering water temperature = 57.0 F

Average hot water supply temperature = 140.0 F

Heating plant type = 1 : Electric

### OTHER INPUTS

Additional building floor area = 0.0 sqft

Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 900 Oil	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	Electric (Energy)	MBTU
Natural Gas	3	Natural Gas (Energy)	MBTU
Fuel Oil	4	Distillate Fuel Oil (Energy)	MBTU
Propane	5	Propane	MBTU
Remote Source Heating	9	Remote Source Heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Building 900 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-26-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<----- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	1	0.000	0.3 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	225	0.039	76.6 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	226	0.039	76.9 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	68	0.012	23.1 %
>>> Non-HVAC Sub-total	68	0.012	23.1 %
>>> GRAND TOTAL	294	0.051	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 5,812 sqft  
 Conditioned floor area = 5,812 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 900 Oil  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-26-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)	% of Total
Electric	267 kWh	1 0.000	0.3 %
Natural Gas	0 Therms	0 0.000	0.0 %
Fuel Oil	1623 gallon	225 0.039	76.6 %
Propane	0 Therms	0 0.000	0.0 %
Remote Heating	0 Therms	0 0.000	0.0 %
Remote Cooling	0 Therms	0 0.000	0.0 %
>>> HVAC Subtotal		226 0.039	76.9 %
Non-HVAC Component			
Electric	19894 kWh	68 0.012	23.1 %
Natural Gas	0 Therms	0 0.000	0.0 %
Fuel Oil	0 gallon	0 0.000	0.0 %
Propane	0 Therms	0 0.000	0.0 %
Remote Heating	0 Therms	0 0.000	0.0 %
>>> Non-HVAC Subtotal		68 0.012	23.1 %
*****			
>>> GRAND TOTAL		294 0.051	100.0 %
*****			

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 5,812 sqft  
 Conditioned floor area = 5,812 sqft

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Building 900 Gas

04-04-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Individual Plants  
Name = Building 900 Gas  
Cooling Plant Type = User Defined  
Heating Plant Type = Combustion

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Dogue Creek unit 1 ex 1	1	Dogue Creek unit 1 int	2
Dogue Creek unit 1 ex 2	1	Dogue Creek bungalow 1	1

\*\*\*\*\*

## 3a COOLING PLANT DATA (User Defined)

Estimated maximum cooling coil load = 0.00 Ton  
Nominal capacity = 0.00 Ton  
Nominal input power rate = 0.000 kW/Ton  
Type of cooling = DX  
Condenser type = Air Cooled

### PART LOAD PERFORMANCE

% Load	% Power	% Load	% Power	% Load	% Power
90 -----	100	60 -----	100	30 -----	100
80 -----	100	50 -----	100	20 -----	100
70 -----	100	40 -----	100	10 -----	100

\*\*\*\*\*

## 3b HEATING PLANT DATA (Combustion)

Estimated maximum heating coil load = 182.64 MBH  
Fuel type = Natural Gas  
Rated plant output = 265.0 MBH  
Type of heating = Direct  
Is plant efficiency computer generated ? N  
Seasonal plant efficiency = 84 %

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

# BUILDING DESCRIPTION

Building : Building 900 Gas

04-04-91

Prepared By: E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1. BUILDING INPUTS

BUILDING NAME = Building 900 Gas

### MISCELLANEOUS ELECTRIC

Maximum power = 0.0 kW  
Power schedule = 4

### DOMESTIC WATER HEATING

Is a domestic hot water system used ? Y  
Maximum hourly hot water use = 35.0 gal  
Hot water schedule = 2  
Average entering water temperature = 57.0 F  
Average hot water supply temperature = 140.0 F  
Heating plant type = 2 : Combustion  
Fuel type = 1 : Natural Gas  
Plant capacity = 200.0 MBH  
Is plant efficiency computer generated ? N  
Annual plant efficiency = 80 %

### OTHER INPUTS

Additional building floor area = 0.0 sqft  
Electrical generating efficiency = 100.00 %

\*\*\*\*\*

## 2. PLANT SELECTION

Plant Name	Mult	Plant Name	Mult
Building 900 Gas	1		

\*\*\*\*\*

## 3. FUEL & ELECTRIC RATE SELECTION

Fuel or Energy	No.	Name of Rate Schedule	Currency
Electric	2	Electric (Energy)	MBTU
Natural Gas	3	Natural Gas (Energy)	MBTU
Fuel Oil	4	Distillate Fuel Oil (Energy)	MBTU
Propane	5	Propane	MBTU
Remote Source Heating	9	Remote Source Heating (generic)	MBTU
Remote Source Cooling	10	Remote Source Cooling (generic)	MBTU

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Building 900 Gas  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	267 kWh	1	0.000	0.3 %
Natural Gas	2091 Therms	209	0.036	70.8 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		210	0.036	71.1 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	854 Therms	85	0.015	28.9 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		85	0.015	28.9 %
-----				
>>> GRAND TOTAL		295	0.051	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,812 sqft  
 Conditioned floor area = 5,812 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Building 900 Gas  
 Site : Fort Belvoir, Virginia  
 Prepared By : E A C

04-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	1	0.000	0.3 %
Cooling Plants	0	0.000	0.0 %
Heating Plants	209	0.036	70.8 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	210	0.036	71.1 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	85	0.015	28.9 %
>>> Non-HVAC Sub-total	85	0.015	28.9 %
>>> GRAND TOTAL	295	0.051	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,812 sqft

Conditioned floor area = 5,812 sqft

\*\*\*\*\*



## FUEL OIL COSTS

Building : #900 OIL - ENERGY (\$)

08-29-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	470	0	0	470
Feb	349	0	0	349
Mar	194	0	0	194
Apr	34	0	0	34
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
Aug	0	0	0	0
Sept	0	0	0	0
Oct	26	0	0	26
Nov	189	0	0	189
Dec	411	0	0	411

Tot.	1,673	0	0	1,673
------	-------	---	---	-------

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	470	63	7.43000
Feb	349	47	7.43000
Mar	194	26	7.43000
Apr	34	5	7.43000
May	0	0	7.43000
June	0	0	7.43000
July	0	0	7.43000
Aug	0	0	7.43000
Sept	0	0	7.43000
Oct	26	3	7.43000
Nov	189	25	7.43000
Dec	411	55	7.43000

Tot.	1,673	225	7.43000
------	-------	-----	---------

\*\*\*\*\*

## FUEL OIL COSTS

Building : #901 OIL - ENERGY (\$)

08-29-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	618	0	0	618
Feb	465	0	0	465
Mar	268	0	0	268
Apr	51	0	0	51
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
Aug	0	0	0	0
Sept	0	0	0	0
Oct	37	0	0	37
Nov	254	0	0	254
Dec	541	0	0	541
Tot.	2,235	0	0	2,235

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	618	83	7.43000
Feb	465	63	7.43000
Mar	268	36	7.43000
Apr	51	7	7.43000
May	0	0	7.43000
June	0	0	7.43000
July	0	0	7.43000
Aug	0	0	7.43000
Sept	0	0	7.43000
Oct	37	5	7.43000
Nov	254	34	7.43000
Dec	541	73	7.43000
Tot.	2,235	301	7.43000

\*\*\*\*\*

## FUEL OIL COSTS

Building : #914 OIL - ENERGY (\$)

08-29-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	898	0	0	898
Feb	666	0	0	666
Mar	368	0	0	368
Apr	64	0	0	64
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
Aug	0	0	0	0
Sept	0	0	0	0
Oct	49	0	0	49
Nov	364	0	0	364
Dec	786	0	0	786
Tot.	3,194	0	0	3,194

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	898	121	7.43000
Feb	666	90	7.43000
Mar	368	49	7.43000
Apr	64	9	7.43000
May	0	0	7.43000
June	0	0	7.43000
July	0	0	7.43000
Aug	0	0	7.43000
Sept	0	0	7.43000
Oct	49	7	7.43000
Nov	364	49	7.43000
Dec	786	106	7.43000
Tot.	3,194	430	7.43000

\*\*\*\*\*

## FUEL OIL COSTS

Building : #922 OIL - ENERGY (\$)

08-29-91

Site : Fort Belvoir, Virginia

6100190202

Prepared By : E A C, PC BURKE, VA.

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

TABLE 1. MONTHLY COMPONENT CHARGES (Dollars)

Month	Energy Charges	Fixed Charges	Taxes	Total Charges
Jan	795	0	0	795
Feb	587	0	0	587
Mar	320	0	0	320
Apr	53	0	0	53
May	0	0	0	0
June	0	0	0	0
July	0	0	0	0
Aug	0	0	0	0
Sept	0	0	0	0
Oct	42	0	0	42
Nov	321	0	0	321
Dec	697	0	0	697
Tot.	2,815	0	0	2,815

\*\*\*\*\*

TABLE 2. MONTHLY TOTALS

Month	Charges (\$)	Energy (MBTU)	Effective Rate (\$/MBTU)
Jan	795	107	7.43000
Feb	587	79	7.43000
Mar	320	43	7.43000
Apr	53	7	7.43000
May	0	0	7.43000
June	0	0	7.43000
July	0	0	7.43000
Aug	0	0	7.43000
Sept	0	0	7.43000
Oct	42	6	7.43000
Nov	321	43	7.43000
Dec	697	94	7.43000
Tot.	2,815	379	7.43000

\*\*\*\*\*

900 AREA (DOGUE CREEK)

**Fuel Conversion:**

Description - Existing oil-fired furnaces used for heating and electric water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -23	MBTU/year
Cost	= \$205,446	(incl. SIOH)
SIR	= 3.84	

## FORT BELVOIR DOGUE CREEK HOUSING AREA

## CONSOLIDATION OF OTHER COSTS

TYP.BLDG	No.	MAINT. COST PER BLDG	ONE TIME REPLAC.COSTS \$ PER BUILDING		MAINT. COSTS \$	ONE TIME REPLAC. COSTS \$	
			ELEC. WH	GAS WH		ELEC. WH	GAS WH
900	28	50	2850	-3236	1400	79800	-90608
901	7	60	3420	-3883	420	23940	-27181
914	8	90	5130	-5825	720	41040	-46600
922	2	80	4560	-5178	160	9120	-10356
TOTAL	45				2700	153900	-174745

Engineering  
Applications  
Consultants

A Professional  
Corporation

9004-B Crownwood Ct.  
Burke, Virginia 22015-1630  
(703) 978-0923

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**ENGINEERING ANALYSIS**

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

**DOGUE CREEK VILLAGE - BUILDING 900 (28 buildings)**

*For evaluating conversion to gas, it is assumed that the project can be implemented in conjunction with the Norfolk District Corps of Engineers Project 24566, design for which is under way. As such, only incremental costs have been considered.*

**Proposed conversion**

Estimated cost of gas-fired furnace	= \$ 5,556
Estimated cost of gas-fired water heater	= \$ 3,236
Total cost of conversion now	= \$ 8,792

**Existing systems**

Estimated cost of oil-fired furnace (under an on-going contract)	= \$ 4,820
Estimated cost of electric water heater	= \$ 2,850
Total cost of replacement now	= \$ 7,670

Incremental cost now = \$ 8,792 - \$ 7,670 = \$ 1,122

Total incremental cost = \$1,122 X 28 (bldg) = \$31,416

**Water heater replacement costs**

Gas-fired waterheaters	= \$3,236 X 28	= \$90,608
Electric water heaters	= \$2,850 X 28	= \$79,800

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 900  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 1: Oil furnaces  
Electric water heaters

Oil furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install oil furnaces	5	each	\$97	\$485	\$650	\$3,250	\$3,735
SUB-TOTAL:				\$485		\$3,250	\$3,735
Labor Markup: 21%				\$102		---	\$102
Taxes: 4.5%				---		\$146	\$146
SUB-TOTAL:				\$587		\$3,396	\$3,983
Overhead: 10%				\$59		\$340	\$398
SUB-TOTAL:				\$646		\$3,736	\$4,381
Profit: 10%				\$65		\$374	\$438
TOTAL:				\$710		\$4,109	\$4,820

Electric water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install electric water heater	5	each	\$195	\$975	\$225	\$1,125	\$2,100
SUB-TOTAL:				\$975		\$1,125	\$2,100
Labor Markup: 21%				\$205		---	\$205
Taxes: 4.5%				---		\$51	\$51
SUB-TOTAL:				\$1,180		\$1,176	\$2,355
Overhead: 10%				\$118		\$118	\$236
SUB-TOTAL:				\$1,298		\$1,293	\$2,591
Profit: 10%				\$130		\$129	\$259
TOTAL:				\$1,427		\$1,423	\$2,850



# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 900  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Gas furnaces  
Gas water heaters

## Gas furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas furnaces	5	each	\$90	\$450	\$540	\$2,700	\$3,150
Remove oil tanks	1	each	\$1,000	\$1,000	\$15	\$15	\$1,015
SUB-TOTAL:				\$1,450		\$2,715	\$4,165
Labor Markup: 21%				\$305		---	\$305
Taxes: 4.5%				---		\$122	\$122
SUB-TOTAL:				\$1,755		\$2,837	\$4,592
Overhead: 10%				\$175		\$284	\$459
SUB-TOTAL:				\$1,930		\$3,121	\$5,051
Profit: 10%				\$193		\$312	\$505
TOTAL:				\$2,123		\$3,433	\$5,556

## Gas water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas water heaters	5	each	\$265	\$1,325	\$205	\$1,025	\$2,350
SUB-TOTAL:				\$1,325		\$1,025	\$2,350
Labor Markup: 21%				\$278		---	\$278
Taxes: 4.5%				---		\$46	\$46
SUB-TOTAL:				\$1,603		\$1,071	\$2,674
Overhead: 10%				\$160		\$107	\$267
SUB-TOTAL:				\$1,764		\$1,178	\$2,942
Profit: 10%				\$176		\$118	\$294
TOTAL:				\$1,940		\$1,296	\$3,236

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ENGINEERING ANALYSIS

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Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

DOGUE CREEK VILLAGE - BUILDING 901 (7 buildings)

*For evaluating conversion to gas, it is assumed that the project can be implemented in conjunction with the Norfolk District Corps of Engineers Project 24566, design for which is under way. As such, only incremental costs have been considered.*

Proposed conversion

Estimated cost of gas-fired furnace	= \$ 6,370
Estimated cost of gas-fired water heater	= \$ 3,883
Total cost of conversion now	= \$10,253

Existing systems

Estimated cost of oil-fired furnace (under an on-going contract)	= \$ 5,783
Estimated cost of electric water heater	= \$ 3,420
Total cost of replacement now	= \$ 9,203

Incremental cost now = \$10,253 - \$ 9,203 = \$ 1,050

Total incremental cost = \$1,050 X 7 (bldg) = \$7,350

Water heater replacement costs

Gas-fired waterheaters	= \$3,883 X 7	= \$27,181
Electric water heaters	= \$3,420 X 7	= \$23,940

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 901  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 1: Oil furnaces  
Electric water heaters

## Oil furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install oil furnaces	6	each	\$97	\$582	\$650	\$3,900	\$4,482
SUB-TOTAL:				\$582		\$3,900	\$4,482
Labor Markup: 21%				\$122		---	\$122
Taxes: 4.5%				---		\$176	\$176
SUB-TOTAL:				\$704		\$4,076	\$4,780
Overhead: 10%				\$70		\$408	\$478
SUB-TOTAL:				\$775		\$4,483	\$5,258
Profit: 10%				\$77		\$448	\$526
TOTAL:				\$852		\$4,931	\$5,783

## Electric water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install electric water heater	6	each	\$195	\$1,170	\$225	\$1,350	\$2,520
SUB-TOTAL:				\$1,170		\$1,350	\$2,520
Labor Markup: 21%				\$246		---	\$246
Taxes: 4.5%				---		\$61	\$61
SUB-TOTAL:				\$1,416		\$1,411	\$2,826
Overhead: 10%				\$142		\$141	\$283
SUB-TOTAL:				\$1,557		\$1,552	\$3,109
Profit: 10%				\$156		\$155	\$311
TOTAL:				\$1,713		\$1,707	\$3,420

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 901  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Gas furnaces  
Gas water heaters

## Gas furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas furnaces	6	each	\$90	\$540	\$540	\$3,240	\$3,780
Remove oil tanks	1	each	\$1,000	\$1,000	\$15	\$15	\$1,015
SUB-TOTAL:				\$1,540		\$3,255	\$4,795
Labor Markup: 21%				\$323		---	\$323
Taxes: 4.5%				---		\$146	\$146
SUB-TOTAL:				\$1,863		\$3,401	\$5,265
Overhead: 10%				\$186		\$340	\$526
SUB-TOTAL:				\$2,050		\$3,742	\$5,791
Profit: 10%				\$205		\$374	\$579
TOTAL:				\$2,255		\$4,116	\$6,370

## Gas water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas water heaters	6	each	\$265	\$1,590	\$205	\$1,230	\$2,820
SUB-TOTAL:				\$1,590		\$1,230	\$2,820
Labor Markup: 21%				\$334		---	\$334
Taxes: 4.5%				---		\$55	\$55
SUB-TOTAL:				\$1,924		\$1,285	\$3,209
Overhead: 10%				\$192		\$129	\$321
SUB-TOTAL:				\$2,116		\$1,414	\$3,530
Profit: 10%				\$212		\$141	\$353
TOTAL:				\$2,328		\$1,555	\$3,883

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ENGINEERING ANALYSIS

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Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

DOGUE CREEK VILLAGE - BUILDING 914 (8 buildings)

*For evaluating conversion to gas, it is assumed that the project can be implemented in conjunction with the Norfolk District Corps of Engineers Project 24566, design for which is under way. As such, only incremental costs have been considered.*

Proposed conversion

Estimated cost of gas-fired furnace	= \$ 8,814
Estimated cost of gas-fired water heater	= \$ 5,825
Total cost of conversion now	= \$14,639

Existing systems

Estimated cost of oil-fired furnace (under an on-going contract)	= \$ 8,675
Estimated cost of electric water heater	= \$ 5,130
Total cost of replacement now	= \$13,805

Incremental cost now = \$14,639 - \$13,805 = \$ 834

Total incremental cost = \$834 X 8 (bldg) = \$ 6,672

Water heater replacement costs

Gas-fired waterheaters	= \$5,825 X 8	= \$46,600
Electric water heaters	= \$5,130 X 8	= \$41,040

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 914  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 1: Oil furnaces  
Electric water heaters

Oil furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install oil furnaces	9	each	\$97	\$873	\$650	\$5,850	\$6,723
SUB-TOTAL:				\$873		\$5,850	\$6,723
Labor Markup: 21%				\$183		---	\$183
Taxes: 4.5%				---		\$263	\$263
JB-TOTAL:				\$1,056		\$6,113	\$7,170
Overhead: 10%				\$106		\$611	\$717
SUB-TOTAL:				\$1,162		\$6,725	\$7,887
Profit: 10%				\$116		\$672	\$789
TOTAL:				\$1,278		\$7,397	\$8,675

Electric water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install electric water heater	9	each	\$195	\$1,755	\$225	\$2,025	\$3,780
SUB-TOTAL:				\$1,755		\$2,025	\$3,780
Labor Markup: 21%				\$369		---	\$369
Taxes: 4.5%				---		\$91	\$91
SUB-TOTAL:				\$2,124		\$2,116	\$4,240
Overhead: 10%				\$212		\$212	\$424
SUB-TOTAL:				\$2,336		\$2,328	\$4,664
Profit: 10%				\$234		\$233	\$466
TOTAL:				\$2,569		\$2,561	\$5,130

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 914  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Gas furnaces  
Gas water heaters

## Gas furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas furnaces	9	each	\$90	\$810	\$540	\$4,860	\$5,670
Remove oil tanks	1	each	\$1,000	\$1,000	\$15	\$15	\$1,015
SUB-TOTAL:				\$1,810		\$4,875	\$6,685
Labor Markup: 21%				\$380		---	\$380
Taxes: 4.5%				---		\$219	\$219
SUB-TOTAL:				\$2,190		\$5,094	\$7,284
Overhead: 10%				\$219		\$509	\$728
SUB-TOTAL:				\$2,409		\$5,604	\$8,013
Profit: 10%				\$241		\$560	\$801
TOTAL:				\$2,650		\$6,164	\$8,814

## Gas water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas water heaters	9	each	\$265	\$2,385	\$205	\$1,845	\$4,230
SUB-TOTAL:				\$2,385		\$1,845	\$4,230
Labor Markup: 21%				\$501		---	\$501
Taxes: 4.5%				---		\$83	\$83
SUB-TOTAL:				\$2,886		\$1,928	\$4,814
Overhead: 10%				\$289		\$193	\$481
SUB-TOTAL:				\$3,174		\$2,121	\$5,295
Profit: 10%				\$317		\$212	\$530
TOTAL:				\$3,492		\$2,333	\$5,825

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ENGINEERING ANALYSIS

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Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

DOGUE CREEK VILLAGE - BUILDING 922 (2 buildings)

*For evaluating conversion to gas, it is assumed that the project can be implemented in conjunction with the Norfolk District Corps of Engineers Project 24566, design for which is under way. As such, only incremental costs have been considered.*

Proposed conversion

Estimated cost of gas-fired furnace	= \$ 8,000
Estimated cost of gas-fired water heater	= \$ 5,178
Total cost of conversion now	= \$13,178

Existing systems

Estimated cost of oil-fired furnace (under an on-going contract)	= \$ 7,711
Estimated cost of electric water heater	= \$ 4,560
Total cost of replacement now	= \$12,271

Incremental cost now = \$13,178 - \$12,271 = \$ 907

Total incremental cost = \$907 X 2 (bldg) = \$ 1,814

Water heater replacement costs

Gas-fired waterheaters	= \$5,178 X 2	= \$10,356
Electric water heaters	= \$4,560 X 2	= \$ 9,120



# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 922  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 1: Oil furnaces  
Electric water heaters

Oil furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install oil furnaces	8	each	\$97	\$776	\$650	\$5,200	\$5,976
SUB-TOTAL:				\$776		\$5,200	\$5,976
Labor Markup: 21%				\$163		---	\$163
Taxes: 4.5%				---		\$234	\$234
SUB-TOTAL:				\$939		\$5,434	\$6,373
Overhead: 10%				\$94		\$543	\$637
SUB-TOTAL:				\$1,033		\$5,977	\$7,010
Profit: 10%				\$103		\$598	\$701
TOTAL:				\$1,136		\$6,575	\$7,711

Electric water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install electric water heater	8	each	\$195	\$1,560	\$225	\$1,800	\$3,360
SUB-TOTAL:				\$1,560		\$1,800	\$3,360
Labor Markup: 21%				\$328		---	\$328
Taxes: 4.5%				---		\$81	\$81
SUB-TOTAL:				\$1,888		\$1,881	\$3,769
Overhead: 10%				\$189		\$188	\$377
SUB-TOTAL:				\$2,076		\$2,069	\$4,145
Profit: 10%				\$208		\$207	\$415
TOTAL:				\$2,284		\$2,276	\$4,560

# CONSTRUCTION COST ESTIMATE

Project: Energy Savings Opportunity Survey

Location: Building 922  
Dogue Creek Village  
Fort Belvoir, VA

By: Engineering Applications Consultants

Alternative 2: Gas furnaces  
Gas water heaters

## Gas furnaces:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas furnaces	8	each	\$90	\$720	\$540	\$4,320	\$5,040
Remove oil tanks	1	each	\$1,000	\$1,000	\$15	\$15	\$1,015
SUB-TOTAL:				\$1,720		\$4,335	\$6,055
Labor Markup: 21%				\$361		---	\$361
Taxes: 4.5%				---		\$195	\$195
SUB-TOTAL:				\$2,081		\$4,530	\$6,611
Overhead: 10%				\$208		\$453	\$661
SUB-TOTAL:				\$2,289		\$4,983	\$7,272
Profit: 10%				\$229		\$498	\$727
TOTAL:				\$2,518		\$5,481	\$8,000

## Gas water heaters:

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install gas water heaters	8	each	\$265	\$2,120	\$205	\$1,640	\$3,760
SUB-TOTAL:				\$2,120		\$1,640	\$3,760
Labor Markup: 21%				\$445		---	\$445
Taxes: 4.5%				---		\$74	\$74
SUB-TOTAL:				\$2,565		\$1,714	\$4,279
Overhead: 10%				\$257		\$171	\$428
SUB-TOTAL:				\$2,822		\$1,885	\$4,707
Profit: 10%				\$282		\$189	\$471
TOTAL:				\$3,104		\$2,074	\$5,178

<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED JULY '91		SHEET 1 OF 1		
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____				
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>DOGUE CREEK (900 AREA)</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VF</b>			
<u>GAS to BLDGS.</u> SUMMARY		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRENCH & BACKFILL 10,000 LF 1.01 10,100. 74 7400. 17,500.								
HAND EXCAVATING 300 CY 34.00 10,200. — 10,200.								
HAND BACKFILLING 300 CY 12.45 3,735. — 3,735.								
POLYETHYLENE PIPE - 1/4" 11,000 LF 1.17 12,870 .55 6,050. 18,920.								
BLACK STEEL PIPE - 3/4" 5,400 LF 3.21 17,334. .87 4,693. 22,028.								
MAIN CONNECTION 160 EA 15.00 2,400. 5.00 800. 3,200.								
STOP VALVES - 3/4" 540 EL 9.00 4,860. 8.05 4,347. 9,207.								
PRESSURE REGULATOR 270 EA 10.00 2,700. 50.00 13,500. 16,200.								
HAULING 60 CY 2.21 133. 4.33 260. 393.								
DISPOSAL OF MATERIALS — LS — 500. — 500.								
MATERIAL HANDL./STORAGE — LS — 400. — 400.								
SEED/SOD — LS — 300. — 300.								
GAS LINE TESTING 160 EA 10.00 1,600. — 1,600.								
GENERAL CLEAN-UP 160 EA 10.00 1,600. — 1,600.								
SUB-TOTAL 63,732. 37,055. 105,787.								
LABOR, INS. & TAXES 21% 14,434. — 14,434.								
SALES TAX 4.5% — 1,667. 1,667.								
SUB-TOTAL 83,166. 38,722 121,888.								
OVERHEAD 10% 12,189.								
SUB-TOTAL 134,077								
PROFIT 10% 12,407								
SUB-TOTAL 147,484								
TOTAL 147,484.								

PROPORTIONATE COST/UNIT =  $\frac{147484}{270}$

= \$ 546.

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ENGINEERING ANALYSIS

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Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991  
Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

DOGUE CREEK VILLAGE - SUMMARY OF INCREMENTAL COSTS

Typical Building 900 (28 buildings)	=	\$ 31,416
Typical building 901 ( 7 buildings)	=	\$ 7,350
Typical building 914 ( 8 buildings)	=	\$ 6,672
Typical building 922 ( 2 buildings)	=	\$ 1,814
Cost to Govt. for curb-to-building gas lines	=	\$147,484
<b>Total - Cost of fuel conversion</b>		<b>\$194,736</b>

Replacement costs of water heaters:

	<u>Gas-fired</u>	<u>Electric</u>
Typical Building 900	\$ 90,608	\$ 79,800
Typical building 901	\$ 27,181	\$ 23,940
Typical building 914	\$ 46,600	\$ 41,040
Typical building 922	\$ 10,356	\$ 9,120
<b>TOTAL</b>	<b>\$174,745</b>	<b>\$153,900</b>

PORT BELVOIR DOGUE CREEK HOUSING AREA

CONSTRUCTION COSTS AND ENERGY SAVINGS CONSOLIDATION

TYP. BLDG	No.	SAVINGS, PER BUILDING			TOTAL SAVINGS		
		ELEC.	OIL	GAS	ELEC.	OIL	GAS
		MBTU	MBTU	MBTU	MBTU	MBTU	MBTU
900	28	68	225	-294	1904	6300	-8232
901	7	82	301	-382	574	2107	-2674
914	8	123	430	-553	984	3440	-4424
922	2	109	379	-489	218	758	-978
TOTAL	45				3680	12605	-16308

**LIFE CYCLE COST ANALYSIS SUMMARY**  
**ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

LOCATION: FORT BELVOIR REGION NO. 3 PROJECT NUMBER DACA-31-89-C-0198  
 PROJECT TITLE: ENERGY SAVINGS OPPORTUNITY SURVEY FISCAL YR. 199  
 DISCRETE PORTION NAME DOQUE CREEK - OIL TO GAS CONVERSION  
 ANALYSIS DATE August '91 ECONOMIC LIFE 15 YEARS PREPARED BY EAC

**1. INVESTMENT**

A. CONSTRUCTION COST	\$	<u>194,736</u>	
B. SIOH	\$	<u>10,710</u>	
C. DESIGN COST	\$	<u>11,684</u>	
D. SALVAGE VALUE	-	<u>\$</u>	
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)			\$ <u>217,130</u>

**2. ENERGY SAVINGS (+) / COST (-)**

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL	COST \$/MBTU/YR(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELEC	\$ <u>18.05</u>	<u>3680</u>	\$ <u>66,424</u>	<u>11.11</u>	\$ <u>737,971</u>
B. DIST	\$ <u>7.43</u>	<u>12,605</u>	\$ <u>93,655</u>	<u>14.26</u>	\$ <u>1,335,520</u>
C. RESID	\$ <u>6.62</u>		\$		\$
D. NG	\$ <u>5.33</u>	<u>-16,308</u>	\$ <u>-86,922</u>	<u>14.45</u>	\$ <u>-1,256,023</u>
E. COAL	\$		\$		\$
F. TOTAL		<u>-23</u>	\$ <u>73,157</u>		\$ <u>817,468</u>

**NONENERGY SAVINGS (+) / COST (-)**

A. ANNUAL RECURRING (+/-)		MAINT.	\$ <u>2,700</u>
(1) DISCOUNT FACTOR (TABLE A)		<u>10.59</u>	
(2) DISCOUNTED SAVING/COST (3A X 3A1)			\$ <u>28,593</u>

**B. NONRECURRING SAVINGS (+) / COST (-)**

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCUR.(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAV- INGS(+) COST(-)(4)
REPL.				
(1) ELEC WH	\$ <u>153,900</u>	<u>10</u>	<u>0.63</u>	\$ <u>96,957</u>
(2)	\$			\$ <u>-110,089</u>
(3) GAS WH	\$ <u>-174,745</u>	<u>10</u>	<u>0.63</u>	\$
(4) TOTAL	\$ <u>-20,845</u>			\$ <u>-13,132</u>

C. TOTAL NONENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 15,461

**D. PROJECT NONENERGY QUALIFICATION TEST**

(1) 25% MAX NONENERGY CALC (2F5 x .33) \$ 269,764  
 a. IF 3D1 IS = OR > 3C GO TO ITEM 4  
 b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) - 1E = \_\_\_\_\_  
 c. IF 3D1 IS = > 1 GO TO ITEM 4  
 D. IF 3D1 IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3 + 3A + (3B1d ÷ YEARS ECONOMIC LIFE) \$ 74,467

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 832,929

6. DISCOUNTED SAVINGS RATION (IF < 1 PROJECT DOES NOT QUALIFY) (S1R) = (5-1E) = 3.84

SIMPLE PAYBACK PERIOD = 2.9 years

BUILDINGS 2600 TO 2787  
WOODLAWN VILLAGE  
(TYPICALS)

2600 AREA (WOODLAWN VILLAGE)

**Fuel Conversion:**

Description - Existing heat pumps and electric water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -9,391	MBTU/year
Cost	= \$1,864,793	(incl. SIOH)
SIR	= 0.72	





2600 AREA (WOODLAWN VILLAGE)

TABLE OF CONTENTS

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ECIP Analysis	
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## DESIGN PARAMETERS, SHGs

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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## DESIGN WEATHER PARAMETERS

City Name.....: Washington  
 Location.....: Dist. of Columbia  
 Latitude.....: 38.9 deg  
 Elevation.....: 14.0 ft  
 Summer Design Dry Bulb Temp.....: 92.0 F  
 Summer Design Wet Bulb Temp.....: 75.0 F  
 Daily Temperature Range.....: 19.0 F  
 Winter Design Dry Bulb Temp.....: 17.0 F  
 Atmospheric Clearness Number.....: 1.00

TABLE 1. MAXIMUM SOLAR HEAT GAINS - AVERAGE DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	24.1	62.5	99.8	113.0	99.8	62.5	24.1	24.1	80.1
Feb	31.7	75.8	107.6	116.0	107.6	75.8	31.7	31.7	107.4
Mar	40.7	87.6	108.1	109.4	108.1	87.6	40.7	40.7	136.8
Apr	59.9	97.7	105.1	98.3	105.1	97.7	59.9	49.1	164.1
May	74.6	103.1	99.0	85.1	99.0	103.1	74.6	54.8	181.4
Jun	84.8	109.2	98.1	80.2	98.1	109.2	84.8	57.8	194.7
Jul	80.3	106.6	98.8	82.5	98.8	106.6	80.3	56.3	188.8
Aug	69.0	104.3	106.5	95.6	106.5	104.3	69.0	52.0	177.3
Sep	52.3	99.9	115.9	113.0	115.9	99.9	52.3	45.2	158.0
Oct	36.2	89.3	119.5	125.0	119.5	89.3	36.2	36.2	128.3
Nov	26.5	67.8	104.1	116.0	104.1	67.8	26.5	26.5	89.6
Dec	21.3	54.3	90.1	103.8	90.1	54.3	21.3	21.3	68.5

TABLE 2. MAXIMUM SOLAR HEAT GAINS - DESIGN DAYS  
(BTU/hr/sqft)

Month	NE	E	SE	S	SW	W	NW	N	Hor
Jan	20.1	157.3	243.1	254.0	243.1	157.3	20.1	20.1	139.2
Feb	52.1	188.2	246.1	238.6	246.1	188.2	52.1	24.5	185.3
Mar	95.2	219.1	235.0	202.5	235.0	219.1	95.2	29.3	227.0
Apr	141.2	224.2	201.1	149.0	201.1	224.2	141.2	34.0	254.7
May	165.8	220.1	171.9	107.1	171.9	220.1	165.8	37.3	267.1
Jun	172.9	215.5	158.0	90.2	158.0	215.5	172.9	47.5	269.0
Jul	163.3	215.7	167.6	103.9	167.6	215.7	163.3	38.2	263.9
Aug	136.0	216.4	194.0	144.0	194.0	216.4	136.0	35.7	250.0
Sep	89.4	206.5	225.0	196.5	225.0	206.5	89.4	30.4	219.5
Oct	51.1	181.8	238.3	231.6	238.3	181.8	51.1	25.3	182.0
Nov	20.5	154.5	239.0	250.1	239.0	154.5	20.5	20.5	138.6
Dec	18.2	139.9	235.2	253.9	235.2	139.9	18.2	18.2	119.3

STATE	Station	WINTER DESIGN DATA HEATING				DEGREE DAYS	SUMMER DESIGN DATA AIR CONDITIONING										SUMMER CRITERIA D.A. AIR CONDITIONING															
		LOCATION					Dry Bulb				Wet Bulb				Dry Bulb		Wet Bulb															
		Lat	Long	Elev feet	99% Dry Bulb	97.5% Wind	Pvg Mean Speed	Heating	1% MCWB	2.5% MCWB	Pvg Daily Range	5% MCWB	1% MCWB	2.5% MCWB	5% MCWB	≥ 93°F	≥ 80°F	≥ 73°F	≥ 67°F	hrs	hrs	hrs										
																							Mean Daily Range		Pvg Wind		1% MCWB		2.5% MCWB		5% MCWB	
																							°	'	°	'	°	'	°	'	°	'
UTAH (CONT)		N	W																													
	Ogden MAP	41 12	112 01	4455	1	5	S	6	6012	93 63	91 61	26	SW	88 61	66 65	64	37	727	0	19												
	Provo	40 13	111 43	4448	1	6	SE	5	5720	98 62	96 62	32	SW	94 61	66 65	64	185	989	0	26												
	Salt Lake City IAP	40 46	111 58	4220	3	8	SSE	6	5983	97 62	95 62	32	N	92 61	66 65	64	139	932	0	26												
	Tooele Army Depot	40 31	112 25	4700	4	7	SE	4	5941	93 61	91 61	24	N	88 60	65 64	63	41	704	0	5												
	Utah Army Depot	41 15	112 00	4270	2	6	S	6	6012	94 63	92 61	26	SW	89 61	66 65	64	59	849	0	19												
	Wendover AF Range	40 44	114 02	4237	8	12	ENE	4	5673	97 60	95 59	25	E	93 59	65 64	62	158	1144	0	4												
VERMONT		N	W																													
	Burlington IAP	44 28	73 09	332	-12	-7	E	7	7876	88 72	85 70	24	SSW	82 69	74 72	71	4	263	67	546												
	St Albans AFS	44 46	73 03	1310	-17	-11	E	9	8790	85 70	82 68	24	SSW	79 67	72 70	69	1	119	21	307												
VIRGINIA		N	W																													
	Arlington Hall	38 52	77 06	200	13	17	WNW	11	4211	94 75	91 74	21	S	89 74	78 77	76	55	815	580	1744												
	Bedford AFS	37 31	79 30	4220	-3	1	NW	9	7382	82 66	80 66	22	SW	77 65	69 68	67	0	87	0	216												
	Cameron Station	38 48	77 07	60	13	17	WNW	11	4211	94 75	91 74	21	S	89 74	78 77	76	55	815	580	1744												
	Camp A P Hill	38 08	77 21	230	10	14	NW	6	4398	96 77	93 76	21	S	90 75	80 78	77	90	897	710	1884												
	Camp Pickett/Blackstone AAF	37 05	77 57	390	15	19	NW	6	3841	95 77	92 76	22	SW	90 76	79 78	77	66	905	804	2086												
	Cape Charles AFS	37 08	75 57	13	20	23	N	11	3474	90 77	88 76	17	SW	86 75	79 78	77	0	596	856	2184												
	Charlottesville	38 02	78 31	870	14	18	NE	7	4162	94 74	91 74	23	SW	88 73	77 76	75	54	964	376	1544												
	Dahlgren NAVSURFWPNCEN	38 20	77 02	21	10	14	NW	6	4498	93 77	91 76	21	S	89 75	80 78	77	39	892	710	1884												
	Dam Neck	36 47	75 57	10	19	22	N	11	3639	91 77	89 76	17	SW	87 75	79 78	77	12	708	856	2184												
	Dulles IAP	38 57	77 27	313	7	11	NW	9	5010	93 74	90 73	23	S	88 73	77 76	75	28	749	386	1417												
	Fort Belvoir/Davison AAF	38 43	77 11	69	8	12	NW	9	4891	92 76	90 75	23	S	88 74	78 77	76	23	781	551	1668												
	Fort Eustis/Felker AAF	37 08	76 37	145	17	20	N	10	3752	92 77	90 76	17	SSW	88 75	80 78	77	26	875	807	2065												
	Fort Lee	37 14	77 21	15	14	17	N	6	3939	95 76	92 76	22	SW	90 75	79 78	77	70	932	765	1973												
	Fort Lee AFS	37 14	77 20	75	14	17	N	6	3939	95 76	92 76	22	SW	90 75	79 78	77	70	932	765	1973												
	Fort Monroe	37 00	76 19	15	17	20	NW	9	3623	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010	2290												
	Fort Myer	38 53	77 05	220	14	17	WNW	11	4211	93 75	91 74	19	S	89 74	78 77	76	41	910	580	1744												
	Fort Story	36 56	76 00	13	19	22	N	11	3639	91 77	89 76	17	SW	87 75	79 78	77	12	708	856	2184												
	Langley AFB/Hampton	37 05	76 21	10	17	20	NW	9	3623	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010	2290												
	Little Creek NAVPHIBASE	36 54	76 09	15	20	22	NW	10	3488	93 77	91 76	19	SW	89 76	79 78	77	41	874	961	2238												
	Lynchburg MAP	37 20	79 12	916	12	16	NE	7	4233	93 74	90 74	23	SW	88 73	77 76	75	31	696	376	1544												
	Manassas/Davis Field	38 43	77 31	186	10	14	NW	6	4398	96 76	93 75	22	S	90 74	78 77	76	90	897	548	1650												
	Newport News/Patrick Henry	37 08	76 30	41	17	20	NW	9	3549	92 78	90 77	17	SW	87 76	79 78	77	21	809	1010	2290												
	Norfolk	36 54	76 12	22	20	22	NW	10	3488	93 77	91 76	19	SW	89 76	79 78	77	41	874	961	2238												

## STUDY PARAMETER INPUT PRINTOUT

Prepared By : E A C  
Advanced Engineering Economic Analysis Program

05-01-91  
60901891.00  
Page 1 of 1

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STUDY CRITERIA

-----  
ECIP - FEMP/10CFR436A (Army TM 5-802-1, Para. 2-3&4)  
-----

Discount Rate : 7.0 %  
Investment Credit : 10.0 %  
Payment Time : 1.0 (1 = end of year)  
-----

\*\*\*\*\*  
KEY STUDY DATES

-----  
ECIP Economic Life : 15 (years)  
-----

\*\*\*\*\*  
ENERGY RELATED STUDY PARAMETERS

-----  
State : VA  
Prices of Electricity : 18.05  
Distillate Oil : 7.43  
Residual Oil : 6.62  
Natural Gas : 5.33  
Coal : 0.00  
-----

Prices are specified in \$ / Million BTU, FEMP Date (JUL 1988)  
-----

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STUDY IDENTIFICATION BLOCK

-----  
Project Title : FORT BELVOIR E.S.O.S  
Installation Name : WOODLAWN VILLAGE  
Project Number : DACA-31-89-C-0198  
Fiscal Year : 1991  
Name of Analyst : E A C, P.C. Burke, Va.  
-----

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PROJECTED NAVFAC COST INDEX  
MONTHLY  
JULY 1989

YEAR	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1974	1156	1154	1155	1177	1177	1199	1233	1240	1238	1246	1239	1240
1975	1242	1265	1265	1269	1287	1307	1317	1330	1333	1351	1349	1354
1976	1362	1370	1378	1391	1398	1416	1425	1455	1467	1476	1479	1484
1977	1489	1499	1504	1506	1507	1521	1539	1554	1587	1617	1603	1606
1978	1609	1617	1620	1621	1652	1663	1696	1705	1720	1721	1732	1734
1979	1740	1740	1750	1749	1753	1809	1829	1849	1900	1899	1902	1909
1980	1895	1894	1915	1899	1888	1916	1950	1971	1976	1981	2000	2017
1981	2015	2016	2014	2064	2076	2083	2109	2118	2139	2156	2186	2184
1982	2184	2200	2195	2195	2220	2219	2233	2253	2249	2248	2260	2295
1983	2311	2348	2352	2347	2351	2388	2414	2428	2430	2416	2419	2406
1984	2402	2407	2412	2422	2419	2417	2418	2428	2430	2424	2421	2408
1985	2410	2414	2406	2405	2411	2429	2448	2442	2440	2441	2446	2439
1986	2440	2446	2447	2458	2479	2493	2499	2498	2504	2511	2511	2511
1987	2515	2510	2518	2523	2524	2525	2538	2557	2565	2569	2564	2589
1988	2574	2576	2586	2591	2592	2595	2598	2611	2612	2612	2616	2617
1989	2619	2613	2616	2620	2621	2626	2633	2640	2648	2655	2663	2670
1990	2677	2683	2690	2697	2704	2710	2717	2724	2731	2738	2744	2751
1991	2757	2763	2769	2776	2782	2788	2794	2800	2806	2812	2819	2825
1992	2830	2835	2840	2845	2850	2855	2861	2866	2871	2876	2881	2886
1993	2891	2896	2900	2905	2910	2914	2919	2924	2928	2933	2938	2942

ANNUAL MARK-UP FACTORS FOR ESCALATION  
(BEYOND FY 93, USE 1.80% ESCALATION COMPOUNDED EACH YEAR)

FISCAL-YEAR	4-87	4-88	4-89	4-90	4-91	4-92	4-93	4-94	4-95
4-83	1.07	1.10	1.12	1.15	1.18	1.21	1.24	1.26	1.28
4-84	1.04	1.07	1.08	1.11	1.15	1.17	1.20	1.22	1.24
4-85	1.05	1.08	1.09	1.12	1.15	1.18	1.21	1.23	1.25
4-86	1.03	1.05	1.07	1.10	1.13	1.16	1.18	1.20	1.22
4-87	1.00	1.03	1.04	1.07	1.10	1.13	1.15	1.17	1.19
4-88	0.97	1.00	1.01	1.04	1.07	1.10	1.12	1.14	1.16
4-89	0.96	0.99	1.00	1.03	1.06	1.09	1.11	1.13	1.15
4-90	0.94	0.96	0.97	1.00	1.03	1.05	1.08	1.10	1.12
4-91	0.91	0.93	0.94	0.97	1.00	1.02	1.05	1.07	1.08
4-92	0.89	0.91	0.92	0.95	0.98	1.00	1.02	1.04	1.06
4-93	0.87	0.89	0.90	0.93	0.96	0.98	1.00	1.02	1.04

NOTE: Escalation rate change to be 1.80% after 1993.

Figure 9  
Projected NAVFAC Cost Index

ENGINEERING ANALYSIS

Sheet 1 of 1

By: JR

Calculations for Infiltration

WOODBRIDGE MILITARY TOWER  
Building

Project: ESOS, Fort 12-1-100 Date: August, 1990

Contract No: DACA-31-89-C-0189 EAC Project No.: 89034.0

Calculations based on ASHRAE 1989 Page F 23.14.

Building Leakage Area

	Effective Leakage Area, in <sup>2</sup>	Building Component Parameter	Building Leakage Area D <sub>L</sub> , in <sup>2</sup>
	L <sub>1</sub>	D <sub>1</sub>	L
Sill foundation	0.04 0.497 ft. of perimeter	334 ft.	14
Joints, ceiling/wall	0.07 0.412 ft. of wall	334 ft.	23
Windows	0.063 0.063 ft <sup>2</sup> of window	380 ft <sup>2</sup> .	16
Doors	0.114 0.215 ft <sup>2</sup> of doors	80 ft <sup>2</sup> .	9
Wall - Window frames	0.15 0.15 ft <sup>2</sup> of window	380 ft <sup>2</sup> .	2
- Door frames	0.072 0.072 ft <sup>2</sup> of door	80 ft <sup>2</sup> .	1
Elec. outlet/switch	0.076 0.16 ft <sup>2</sup> of electrical outlet	100 ft.	8
Recessed lights	1.6/fixture	12	20
Pipe penetration	0.155 1.55 in <sup>2</sup> of pipe	8	1
Exhaust Fans	6.0/fan	108	60 48
Duct penetration	2.2/SF	10SF	22
			<u>164</u>

$$\begin{aligned} \text{Infiltration } Q(\text{cfm}) &= L \times (A \Delta t + B v^2)^{1/2} \\ &= L(0.0313 \times 51 + 0.0086 \times 14^2)^{1/2} \\ &= L \times 1.81 = 164 \times 1.81 = 297 \text{ CFM} \end{aligned}$$

$$\begin{aligned} \text{Infiltration through walls} &= 0.1 \times 5600(\text{SF}) \\ &= 560 \text{ CFM} \end{aligned}$$

92  
(ASHRAE 1989, p. 23.13)

$$\text{Total Infiltration} = 297 + 560 = 857 \text{ CFM}$$

$$\text{Infiltration Rate} = \frac{857}{7200} = 0.119 = 0.12 \text{ CFM/SF}$$

(through typical units)

## SIMPLE SPACE DESCRIPTION

Space Name : Woodlawn type 1 upstairs

04-26-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.069	0.049	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades ?	N

People : sqft/person = 500.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = Woodlawn type 1 upstairs

		Floor Area :	1,452.0 sqft
Exposure :	E	W Roof Area :	1,452.0 sqft
Wall Area :	278.0	Current	
Glass Area :	0.0	44.0 Elements :	Wl,Gl,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Wall

-----

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	423.0 sqft
U-Value =	0.069 BTU/hr/sqft/F		

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

-----

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	65.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

-----

Cooling :	0.12 CFM/sqft =	174 CFM
Heating :	0.12 CFM/sqft =	174 CFM
Typical :	0.12 CFM/sqft =	174 CFM

\*\*\*\*\*



## SIMPLE SPACE DESCRIPTION

Space Name : Woodlawn type 1 down.

04-26-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.069	0.049	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	N

People : sqft/person = 500.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

SPACE NAME = Woodlawn type 1 down.

		Floor Area :	1,452.0 sqft
Exposure :	E	W Roof Area :	0.0 sqft
Wall Area :	278.0	234.0	Current
Glass Area :	0.0	44.0	Elements : Wl,Gl,Gr,In

\*\*\*\*\*

## ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	423.0 sqft
U-Value =	0.069 BTU/hr/sqft/F		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	65.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

## ADDITIONAL ELEMENT - Ground

Slab Floor Area =	1,452.0 sqft
Perimeter =	110.0 ft
Depth =	0.0 ft

\*\*\*\*\*

## ADDITIONAL ELEMENT - Infiltration

Cooling :	0.12 CFM/sqft =	174 CFM
Heating :	0.12 CFM/sqft =	174 CFM
Typical :	0.12 CFM/sqft =	174 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Woodlawn type 2 exterior

04-26-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.069	0.049	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	? N

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1  
 Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
 : Fixture Type = 3 Free-hanging

-----  
SPACE NAME = Woodlawn type 2 exterior

			Floor Area :	1,852.0 sqft
Exposure :	E	W	Roof Area :	981.0 sqft
Wall Area :	545.0	556.0	Current	
Glass Area :	40.0	49.0	Elements :	Wl,Gl,Gr,In

\*\*\*\*\*

ADDITIONAL ELEMENT - Wall

Weight =	M (lb/sqft)	Exposure =	S
Color =	M	Net Area =	403.0 sqft
U-Value =	0.069 BTU/hr/sqft/F		

\*\*\*\*\*

ADDITIONAL ELEMENT - Glass

U-Value =	0.550 BTU/hr/sqft/F	Exposure =	S
Glass Factor =	0.90	Area =	12.0 sqft
Internal Shades ?	N		

\*\*\*\*\*

ADDITIONAL ELEMENT - Ground

Slab Floor Area =	871.0 sqft
Perimeter =	95.0 ft
Depth =	0.0 ft

\*\*\*\*\*

ADDITIONAL ELEMENT - Infiltration

Cooling :	0.12 CFM/sqft =	222 CFM
Heating :	0.12 CFM/sqft =	222 CFM
Typical :	0.12 CFM/sqft =	222 CFM

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Woodlawn type 2 interior

04-26-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

	Walls	Roof	Glass		
U-Value :	0.069	0.049	0.550	Building Weight :	M
Weight :	M	M		Glass Factor :	0.90
Color :	M	M		Internal Shades :	N

People : sqft/person = 500.0 Schedule = 1 Activity Level = 1  
Lights : W/sqft = 0.00 Schedule = 2 Wattage Mult. = 1.00  
: Fixture Type = 3 Free-hanging

-----  
SPACE NAME = Woodlawn type 2 interior

		Floor Area :	1,852.0 sqft
Exposure :	E	W Roof Area :	981.0 sqft
Wall Area :	545.0	Current	
Glass Area :	40.0	Elements :	Gr, In

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground

-----

Slab Floor Area	=	871.0 sqft
Perimeter	=	72.0 ft
Depth	=	0.0 ft

-----

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration

-----

Cooling	:	0.12 CFM/sqft	=	222 CFM
Heating	:	0.12 CFM/sqft	=	222 CFM
Typical	:	0.12 CFM/sqft	=	222 CFM

-----

\*\*\*\*\*

## SIMPLE SPACE DESCRIPTION

Space Name : Woodlawn type 3

04-26-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

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```

*****
Walls      Roof      Glass
U-Value :   0.069   0.049   0.550   Building Weight : M
Weight :      M      M           Glass Factor : 0.90
Color :      M      M           Internal Shades ? N
  
```

```

People : sqft/person = 400.0 Schedule = 1 Activity Level = 1
Lights : W/sqft      = 0.00 Schedule = 2 Wattage Mult. = 1.00
       : Fixture Type = 3 Free-hanging
  
```

SPACE NAME = Woodlawn type 3

```

Floor Area : 2,073.0 sqft
Exposure : E W Roof Area : 1,036.0 sqft
Wall Area : 555.0 470.0 Current
Glass Area : 30.0 135.0 Elements : Gl,Wl,Wl,Gr,In
  
```

\*\*\*\*\*  
ADDITIONAL ELEMENT - Glass

```

U-Value = 0.550 BTU/hr/sqft/F Exposure = S
Glass Factor = 0.90 Area = 10.0 sqft
Internal Shades ? N
  
```

\*\*\*\*\*  
ADDITIONAL ELEMENT - Wall

```

Weight = M (lb/sqft) Exposure = S
Color = M Net Area = 485.0 sqft
U-Value = 0.069 BTU/hr/sqft/F
  
```

\*\*\*\*\*  
ADDITIONAL ELEMENT - Wall

```

Weight = M (lb/sqft) Exposure = N
Color = M Net Area = 495.0 sqft
U-Value = 0.069 BTU/hr/sqft/F
  
```

\*\*\*\*\*  
ADDITIONAL ELEMENT - Ground

```

Slab Floor Area = 1,036.0 sqft
Perimeter = 130.0 ft
Depth = 0.0 ft
  
```

\*\*\*\*\*  
ADDITIONAL ELEMENT - Infiltration

```

Cooling : 0.12 CFM/sqft = 249 CFM
Heating : 0.12 CFM/sqft = 249 CFM
Typical : 0.12 CFM/sqft = 249 CFM
  
```

# DESIGN SPACE COOLING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 1

Calc Time: Aug 1600h

Job Name : Fort Belvoir

Amb db/wb: 91.4/ 74.9 F

Space Name	Mult	Space Sensible ( tons /space)	Supply Air (CFM/space)
Woodlawn type 1 upstairs x 2		1.37	759.7
Woodlawn type 1 down. x 2		1.17	648.0

# DESIGN SPACE HEATING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 1

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
Woodlawn type 1 upstairs x	2	21,525.7	906.4
Woodlawn type 1 down. x	2	21,596.3	909.4

\*\*\*\*\*

# ZONE DESIGN COOLING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 1

Calc Time: Aug 1600h

Job Name : Fort Belvoir

Amb db/wb: 91.4/ 74.9 F

\*\*\*\*\*

## LOAD INFORMATION

LOAD COMPONENT	SENSIBLE (BTU/hr)	LATENT (BTU/hr)
SOLAR LOAD	26,204	0
GLASS TRANSMISSION	3,233	0
WALL TRANSMISSION	6,427	0
ROOF TRANSMISSION	4,387	0
PARTITION TRANSMISSION	0	0
LIGHTING ( 0 W TOTAL)	0	0
OTHER ELEC. ( 0 W TOTAL)	0	0
PEOPLE ( 11.62 PEOPLE TOTAL)	2,668	1,394
MISCELLANEOUS LOADS	0	0
COOLING INFILTRATION	12,339	14,938
PULLDOWN/WARM-UP	0	0
COOLING SAFETY LOAD	5,526	1,633
SUB-TOTALS	60,783	17,965
NET VENTILATION LOAD ( 0 CFM)	0	0
SUPPLY FAN LOAD (BHP= 0.2)	563	0
WALL LOAD TO PLENUM	0	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0
TOTAL COOLING LOADS	61,346	17,965

\*\*\*\*\*

## COIL SELECTION PARAMETERS:

COIL ENTERING AIR TEMP. (DB/WB)	=	75.0/ 64.1 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	54.8/ 54.3 deg F
COIL SENSIBLE LOAD	=	61,346 BTU/hr
COIL TOTAL LOAD	=	79,311 BTU/hr
COOLING SUPPLY AIR TEMPERATURE	=	55.0 deg F
TOTAL COOLING CFM (actual)	=	2,815 CFM
TOTAL COOLING CFM (std. air)	=	2,814 CFM
RESULTING ROOM REL. HUMIDITY	=	54.7 %
COIL BYPASS FACTOR	=	0.050
COIL APPARATUS DEWPOINT	=	53.8 deg F
REHEAT REQUIRED	=	0 BTU/hr

\*\*\*\*\*

## GENERAL INFORMATION:

TOTAL COOLING LOAD	=	6.61 Tons
	=	878.77 sqft/Tons
TOTAL FLOOR AREA	=	5,808.00 sqft
OVERALL U-FACTOR	=	0.090 BTU/hr/sqft/F
COOLING CFM/sqft	=	0.48 CFM/sqft

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Washington, Dist. of Columbia 05-01-91  
 Prepared By : E A C 6100190202  
 Carrier Hourly Analysis Program Page 1 of 1

\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 1 Calc Time: Winter design  
 Job Name : Fort Belvoir Amb db : 17.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	13,161
ROOF TRANSMISSION	7,257
GLASS TRANSMISSION	12,230
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	38,370
SLAB FLOOR	7,385
HEATING SAFETY BTU/hr	7,840
SUB-TOTAL	86,244
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	86,244
HEATING SUPPLY CFM	3,632 CFM
HEATING SUPPLY AIR TEMPERATURE	90.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*



# DESIGN SPACE COOLING LOADS

Location : Washington, Dist. of Columbia

05-01-91

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 2

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

Space Name	Mult	Space Sensible ( tons /space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x 2		1.48	820.4

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 2

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x	2	28,506.8	1,200.4

\*\*\*\*\*

# ZONE DESIGN COOLING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 2

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

## LOAD INFORMATION

LOAD COMPONENT	SENSIBLE (BTU/hr)	LATENT (BTU/hr)
SOLAR LOAD	12,749	0
GLASS TRANSMISSION	1,419	0
WALL TRANSMISSION	5,236	0
ROOF TRANSMISSION	3,428	0
PARTITION TRANSMISSION	0	0
LIGHTING ( 0 W TOTAL)	0	0
OTHER ELEC. ( 0 W TOTAL)	0	0
PEOPLE ( 9.26 PEOPLE TOTAL)	2,127	1,111
MISCELLANEOUS LOADS	0	0
COOLING INFILTRATION	7,245	9,192
PULLDOWN/WARM-UP	0	0
COOLING SAFETY LOAD	3,220	1,030
SUB-TOTALS	35,424	11,334
NET VENTILATION LOAD ( 0 CFM)	0	0
SUPPLY FAN LOAD (BHP= 0.1)	328	0
WALL LOAD TO PLENUM	0	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0
TOTAL COOLING LOADS	35,752	11,334

\*\*\*\*\*

## COIL SELECTION PARAMETERS:

COIL ENTERING AIR TEMP. (DB/WB)	=	75.0/ 64.2 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	54.8/ 54.3 deg F
COIL SENSIBLE LOAD	=	35,752 BTU/hr
COIL TOTAL LOAD	=	47,086 BTU/hr
COOLING SUPPLY AIR TEMPERATURE	=	55.0 deg F
TOTAL COOLING CFM (actual)	=	1,641 CFM
TOTAL COOLING CFM (std. air)	=	1,640 CFM
RESULTING ROOM REL. HUMIDITY	=	55.3 %
COIL BYPASS FACTOR	=	0.050
COIL APPARATUS DEWPOINT	=	53.8 deg F
REHEAT REQUIRED	=	0 BTU/hr

\*\*\*\*\*

## GENERAL INFORMATION:

TOTAL COOLING LOAD	=	3.92 Tons
	=	943.97 sqft/Tons
TOTAL FLOOR AREA	=	3,704.00 sqft
OVERALL U-FACTOR	=	0.080 BTU/hr/sqft/F
COOLING CFM/sqft	=	0.44 CFM/sqft

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

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\*\*\*\*\*  
 CALCULATION DATA:

Zone Name : Building type 2

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	10,585
ROOF TRANSMISSION	4,903
GLASS TRANSMISSION	5,666
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	24,470
SLAB FLOOR	6,206
HEATING SAFETY BTU/hr	5,183
SUB-TOTAL	57,014
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	57,014
HEATING SUPPLY CFM	2,401 CFM
HEATING SUPPLY AIR TEMPERATURE	90.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# DESIGN SPACE COOLING LOADS

Location : Washington, Dist. of Columbia

05-01-91

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 3

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

Space Name	Mult	Space Sensible ( tons /space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x 2		1.48	820.4
Woodlawn type 2 interior x 2		1.35	750.9

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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## CALCULATION DATA:

Zone Name : Building type 3

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x	2	28,506.8	1,200.4
Woodlawn type 2 interior x	2	25,802.4	1,086.5

\*\*\*\*\*

# ZONE DESIGN COOLING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 3

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

## LOAD INFORMATION

LOAD COMPONENT	SENSIBLE (BTU/hr)	LATENT (BTU/hr)
SOLAR LOAD	24,710	0
GLASS TRANSMISSION	2,669	0
WALL TRANSMISSION	9,126	0
ROOF TRANSMISSION	6,855	0
PARTITION TRANSMISSION	0	0
LIGHTING ( 0 W TOTAL)	0	0
OTHER ELEC. ( 0 W TOTAL)	0	0
PEOPLE ( 16.67 PEOPLE TOTAL)	3,829	2,000
MISCELLANEOUS LOADS	0	0
COOLING INFILTRATION	14,490	18,224
PULLDOWN/WARM-UP	0	0
COOLING SAFETY LOAD	6,168	2,022
SUB-TOTALS	67,847	22,247
NET VENTILATION LOAD ( 0 CFM)	0	0
SUPPLY FAN LOAD (BHP= 0.2)	629	0
WALL LOAD TO PLENUM	0	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0
TOTAL COOLING LOADS	68,476	22,247

## COIL SELECTION PARAMETERS:

COIL ENTERING AIR TEMP. (DB/WB)	=	75.0/ 64.3 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	54.8/ 54.3 deg F
COIL SENSIBLE LOAD	=	68,476 BTU/hr
COIL TOTAL LOAD	=	90,722 BTU/hr
COOLING SUPPLY AIR TEMPERATURE	=	55.0 deg F
TOTAL COOLING CFM (actual)	=	3,143 CFM
TOTAL COOLING CFM (std. air)	=	3,141 CFM
RESULTING ROOM REL. HUMIDITY	=	55.5 %
COIL BYPASS FACTOR	=	0.050
COIL APPARATUS DEWPOINT	=	53.8 deg F
REHEAT REQUIRED	=	0 BTU/hr

## GENERAL INFORMATION:

TOTAL COOLING LOAD	=	7.56 Tons
	=	979.87 sqft/Tons
TOTAL FLOOR AREA	=	7,408.00 sqft
OVERALL U-FACTOR	=	0.080 BTU/hr/sqft/F
COOLING CFM/sqft	=	0.42 CFM/sqft

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Washington, Dist. of Columbia 05-01-91  
 Prepared By : E A C 6100190202  
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## CALCULATION DATA:

Zone Name : Building type 3 Calc Time: Winter design  
 Job Name : Fort Belvoir Amb db : 17.0 F

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	18,334
ROOF TRANSMISSION	9,806
GLASS TRANSMISSION	10,659
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	48,941
SLAB FLOOR	11,004
HEATING SAFETY BTU/hr	9,874
SUB-TOTAL	108,618
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	108,618
HEATING SUPPLY CFM	4,574 CFM
HEATING SUPPLY AIR TEMPERATURE	90.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F



# DESIGN SPACE COOLING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 4

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

Space Name	Mult	Space Sensible ( tons /space)	Supply Air (CFM/space)
Woodlawn type 3	x 2	2.24	1,247.3

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 4

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
Woodlawn type 3	x 2	35,705.5	1,503.5

\*\*\*\*\*

# ZONE DESIGN COOLING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 4

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

## LOAD INFORMATION

LOAD COMPONENT	SENSIBLE (BTU/hr)	LATENT (BTU/hr)
SOLAR LOAD	26,107	0
GLASS TRANSMISSION	2,458	0
WALL TRANSMISSION	6,287	0
ROOF TRANSMISSION	3,620	0
PARTITION TRANSMISSION	0	0
LIGHTING ( 0 W TOTAL)	0	0
OTHER ELEC. ( 0 W TOTAL)	0	0
PEOPLE ( 10.36 PEOPLE TOTAL)	2,381	1,244
MISCELLANEOUS LOADS	0	0
COOLING INFILTRATION	8,110	11,065
PULLDOWN/WARM-UP	0	0
COOLING SAFETY LOAD	4,896	1,231
SUB-TOTALS	53,859	13,539
NET VENTILATION LOAD ( 0 CFM)	0	0
SUPPLY FAN LOAD (BHP= 0.2)	499	0
WALL LOAD TO PLENUM	0	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0
TOTAL COOLING LOADS	54,358	13,539

## COIL SELECTION PARAMETERS:

COIL ENTERING AIR TEMP. (DB/WB)	=	75.0/ 63.7 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	54.8/ 54.3 deg F
COIL SENSIBLE LOAD	=	54,358 BTU/hr
COIL TOTAL LOAD	=	67,898 BTU/hr
COOLING SUPPLY AIR TEMPERATURE	=	55.0 deg F
TOTAL COOLING CFM (actual)	=	2,495 CFM
TOTAL COOLING CFM (std. air)	=	2,493 CFM
RESULTING ROOM REL. HUMIDITY	=	53.5 %
COIL BYPASS FACTOR	=	0.050
COIL APPARATUS DEWPOINT	=	53.8 deg F
REHEAT REQUIRED	=	0 BTU/hr

## GENERAL INFORMATION:

TOTAL COOLING LOAD	=	5.66 Tons
	=	732.75 sqft/Tons
TOTAL FLOOR AREA	=	4,146.00 sqft
OVERALL U-FACTOR	=	0.089 BTU/hr/sqft/F
COOLING CFM/sqft	=	0.60 CFM/sqft

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 4

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	14,111
ROOF TRANSMISSION	5,178
GLASS TRANSMISSION	9,818
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	27,390
SLAB FLOOR	8,422
HEATING SAFETY BTU/hr	6,492
SUB-TOTAL	71,411
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	71,411
HEATING SUPPLY CFM	3,007 CFM
HEATING SUPPLY AIR TEMPERATURE	90.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*

# DESIGN SPACE COOLING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 5

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

Space Name	Mult	Space Sensible ( tons /space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x 2		1.48	820.4
Woodlawn type 2 interior x 1		1.35	750.9

\*\*\*\*\*

# DESIGN SPACE HEATING LOADS

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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## CALCULATION DATA:

Zone Name : Building type 5

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

Space Name	Mult	Space Sensible (BTU/hr/space)	Supply Air (CFM/space)
Woodlawn type 2 exterior x	2	28,506.8	1,200.4
Woodlawn type 2 interior x	1	25,802.4	1,086.5

\*\*\*\*\*

# ZONE DESIGN COOLING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 5

Calc Time: Jul 1700h

Job Name : Fort Belvoir

Amb db/wb: 90.1/ 74.5 F

\*\*\*\*\*

## LOAD INFORMATION

LOAD COMPONENT	SENSIBLE (BTU/hr)	LATENT (BTU/hr)
SOLAR LOAD	18,729	0
GLASS TRANSMISSION	2,044	0
WALL TRANSMISSION	7,181	0
ROOF TRANSMISSION	5,141	0
PARTITION TRANSMISSION	0	0
LIGHTING ( 0 W TOTAL)	0	0
OTHER ELEC. ( 0 W TOTAL)	0	0
PEOPLE ( 12.96 PEOPLE TOTAL)	2,978	1,556
MISCELLANEOUS LOADS	0	0
COOLING INFILTRATION	10,868	13,709
PULLDOWN/WARM-UP	0	0
COOLING SAFETY LOAD	4,694	1,526
SUB-TOTALS	51,635	16,791
NET VENTILATION LOAD ( 0 CFM)	0	0
SUPPLY FAN LOAD (BHP= 0.2)	479	0
WALL LOAD TO PLENUM	0	0
ROOF LOAD TO PLENUM	0	0
LIGHTING LOAD TO PLENUM	0	0
TOTAL COOLING LOADS	52,114	16,791

\*\*\*\*\*

## COIL SELECTION PARAMETERS:

COIL ENTERING AIR TEMP. (DB/WB)	=	75.0/ 64.3 deg F
COIL LEAVING AIR TEMP. (DB/WB)	=	54.8/ 54.3 deg F
COIL SENSIBLE LOAD	=	52,114 BTU/hr
COIL TOTAL LOAD	=	68,905 BTU/hr
COOLING SUPPLY AIR TEMPERATURE	=	55.0 deg F
TOTAL COOLING CFM (actual)	=	2,392 CFM
TOTAL COOLING CFM (std. air)	=	2,391 CFM
RESULTING ROOM REL. HUMIDITY	=	55.4 %
COIL BYPASS FACTOR	=	0.050
COIL APPARATUS DEWPOINT	=	53.8 deg F
REHEAT REQUIRED	=	0 BTU/hr

\*\*\*\*\*

## GENERAL INFORMATION:

TOTAL COOLING LOAD	=	5.74 Tons
	=	967.59 sqft/Tons
TOTAL FLOOR AREA	=	5,556.00 sqft
OVERALL U-FACTOR	=	0.080 BTU/hr/sqft/F
COOLING CFM/sqft	=	0.43 CFM/sqft

\*\*\*\*\*

# ZONE DESIGN HEATING LOAD SUMMARY

Location : Washington, Dist. of Columbia

05-01-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## CALCULATION DATA:

Zone Name : Building type 5

Calc Time: Winter design

Job Name : Fort Belvoir

Amb db : 17.0 F

\*\*\*\*\*

LOAD COMPONENT	LOAD (BTU/hr)
WALL TRANSMISSION	14,460
ROOF TRANSMISSION	7,355
GLASS TRANSMISSION	8,163
TRANSMISSION LOSS TO UNCOND. SPACES	0
INFILTRATION LOSS	36,705
SLAB FLOOR	8,605
HEATING SAFETY BTU/hr	7,529
SUB-TOTAL	82,816
NET VENTILATION LOSS	0
TOTAL HEATING LOAD	82,816
HEATING SUPPLY CFM	3,487 CFM
HEATING SUPPLY AIR TEMPERATURE	90.0 deg F
HEATING VENTILATION AIR CFM	0 CFM
HEATING THERMOSTAT SETPOINT TEMP	68.0 deg F

\*\*\*\*\*



# AIR SYSTEM DESCRIPTION

Name : Typical building 1  
Carrier Hourly Analysis Program  
Prepared By : E A C

05-01-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = Typical building 1  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
Heating supply temperature = 95.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : Typical building 1  
Carrier Hourly Analysis Program  
Prepared By : E A C

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Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.60 in wg  
Efficiency = 60 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050

Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Typical building 2  
Carrier Hourly Analysis Program  
Prepared By : E A C

05-01-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = Typical building 2  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
Heating supply temperature = 95.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : Typical building 2  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.60 in wg  
Efficiency = 60 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Typical building 3  
Carrier Hourly Analysis Program  
Prepared By : E A C

05-01-91  
6100190202  
Page 1 of 2

## 1. SYSTEM NAME AND TYPE

System Name = Typical building 3  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

## 2. SPACE SELECTION (see separate printout)

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
Heating supply temperature = 95.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

# AIR SYSTEM DESCRIPTION

Name : Typical building 3  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.60 in wg  
Efficiency = 60 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Typical building 4  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 1 of 2

\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = Typical building 4  
System Class = Constant Volume  
System Type = (SZCV) Single Zone Constant Volume  
Operation Type = 2 Heating Only  
Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED

-----  
Weekday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Saturday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Sunday : Occupied Period Begins at 0 ; Duration = 24 hrs  
Design Day : Occupied Period Begins at 0 ; Duration = 24 hrs  
-----

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
Heating supply temperature = 95.0 F  
Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
Minimum ventilation flow rate = 0.00 % of supply air  
Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 % of vent. air  
Zone exhaust fan power = 0.0 kW  
Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Typical building 4  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.60 in wg  
Efficiency = 60 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*



# AIR SYSTEM DESCRIPTION

Name : Typical building 5

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Carrier Hourly Analysis Program

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Prepared By : E A C

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\*\*\*\*\*

## 1. SYSTEM NAME AND TYPE

System Name = Typical building 5  
 System Class = Constant Volume  
 System Type = (SZCV) Single Zone Constant Volume  
 Operation Type = 2 Heating Only  
 Type of Heating = 1 Central Heating

\*\*\*\*\*

## 2. SPACE SELECTION (see separate printout)

\*\*\*\*\*

## 3. THERMOSTAT & EQUIPMENT SCHEDULING DATA

Operation Period	Thermostat Setpoints		Ventilation Dampers
	Cooling	Heating	
Occupied	75.0 F	68.0 F	CLOSED
Unoccupied	75.0 F	68.0 F	CLOSED
Weekday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Saturday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Sunday	: Occupied Period Begins at 0 ; Duration = 24 hrs		
Design Day	: Occupied Period Begins at 0 ; Duration = 24 hrs		

\*\*\*\*\*

## 4. SUPPLY, VENTILATION, RETURN AIR DATA

### SUPPLY AIR

Supply air temperature = 55.0 F  
 Heating supply temperature = 95.0 F  
 Fan operation for heating = 2 Cycled

### VENTILATION AIR

Nominal ventilation flow rate = 0.00 % of supply air  
 Minimum ventilation flow rate = 0.00 % of supply air  
 Damper leak rate = 0 % of vent air

### RETURN AIR

Zone exhaust air flow rate = 0.00 % of vent. air  
 Zone exhaust fan power = 0.0 kW  
 Is a return plenum used ? N

\*\*\*\*\*

# AIR SYSTEM DESCRIPTION

Name : Typical building 5  
Carrier Hourly Analysis Program  
Prepared By : E A C

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6100190202  
Page 2 of 2

\*\*\*\*\*

## 5. FAN DATA

### SUPPLY FAN

Type = 2:Forward curved  
Static = 0.60 in wg  
Efficiency = 60 %  
Configuration = 1 Draw-thru

### RETURN FAN

Type = 1:(Fan does not exist)

\*\*\*\*\*

## 6. ACCESSORY DEVICES AND SYSTEMS

### PREHEAT COIL

(Not used)

### OUTDOOR AIR ECONOMIZER CONTROL

(Not used)

### VENTILATION AIR RECLAIM

(Not used)

### HUMIDITY CONTROL

(Not used)

\*\*\*\*\*

## 7. MISCELLANEOUS SYSTEM DATA

Cooling coil bypass factor = 0.050  
Type of supplemental heating = 1 Not Used

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Typical building 1,elect

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\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Heat Pumps  
Name = Typical building 1,elect  
Heat Pump Type = Air Source Heat Pump  
Auxiliary Plant Type = Electrical Resistance

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Typical building 1	1		

\*\*\*\*\*

## 3 PLANT CHARACTERISTICS (Air Source Heat Pump)

### COOLING DATA

Estimated maximum cooling coil load = 6.04 Ton  
Capacity at 95.0 F outdoor air = 8.00 Ton  
Input power rate at 95.0 F outdoor air = 1.200 kW/Ton

### HEATING DATA

Estimated maximum heating coil load = 76.56 MBH  
Capacity at 47.0 F outdoor air = 96.0 MBH  
Compressor, evaporator fan kW at 47.0 F outdoor air = 10.0 kW  
Outdoor air temperature for cutoff = 15.0 F

### AUXILIARY PLANT DATA

Plant type = Electrical  
Estimated maximum heating coil load = 76.56 MBH  
Type of heating = Direct

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Typical building 2,elect

05-02-91

Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Heat Pumps  
 Name = Typical building 2,elect  
 Heat Pump Type = Air Source Heat Pump  
 Auxiliary Plant Type = Electrical Resistance

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Typical building 2	1		

\*\*\*\*\*

## 3 PLANT CHARACTERISTICS (Air Source Heat Pump)

### COOLING DATA

Estimated maximum cooling coil load = 3.60 Ton  
 Capacity at 95.0 F outdoor air = 4.00 Ton  
 Input power rate at 95.0 F outdoor air = 1.200 kW/Ton

### HEATING DATA

Estimated maximum heating coil load = 48.25 MBH  
 Capacity at 47.0 F outdoor air = 24.0 MBH  
 Compressor, evaporator fan kW at 47.0 F outdoor air = 5.0 kW  
 Outdoor air temperature for cutoff = 15.0 F

### AUXILIARY PLANT DATA

Plant type = Electrical  
 Estimated maximum heating coil load = 48.25 MBH  
 Type of heating = Direct

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Typical building 3,elect

05-02-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Heat Pumps  
Name = Typical building 3,elect  
Heat Pump Type = Air Source Heat Pump  
Auxiliary Plant Type = Electrical Resistance

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Typical building 3	1		

\*\*\*\*\*

## 3 PLANT CHARACTERISTICS (Air Source Heat Pump)

### COOLING DATA

Estimated maximum cooling coil load = 6.94 Ton  
Capacity at 95.0 F outdoor air = 8.00 Ton  
Input power rate at 95.0 F outdoor air = 1.200 kW/Ton

### HEATING DATA

Estimated maximum heating coil load = 92.06 MBH  
Capacity at 47.0 F outdoor air = 96.0 MBH  
Compressor, evaporator fan kW at 47.0 F outdoor air = 10.0 kW  
Outdoor air temperature for cutoff = 15.0 F

### AUXILIARY PLANT DATA

Plant type = Electrical  
Estimated maximum heating coil load = 92.06 MBH  
Type of heating = Direct

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Typical building 4,elect  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

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 Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Heat Pumps  
 Name = Typical building 4,elect  
 Heat Pump Type = Air Source Heat Pump  
 Auxiliary Plant Type = Electrical Resistance

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Typical building 4	1		

\*\*\*\*\*

## 3 PLANT CHARACTERISTICS (Air Source Heat Pump)

### COOLING DATA

Estimated maximum cooling coil load = 5.19 Ton  
 Capacity at 95.0 F outdoor air = 5.00 Ton  
 Input power rate at 95.0 F outdoor air = 1.200 kW/Ton

### HEATING DATA

Estimated maximum heating coil load = 64.03 MBH  
 Capacity at 47.0 F outdoor air = 62.0 MBH  
 Compressor, evaporator fan kW at 47.0 F outdoor air = 5.0 kW  
 Outdoor air temperature for cutoff = 15.0 F

### AUXILIARY PLANT DATA

Plant type = Electrical  
 Estimated maximum heating coil load = 64.03 MBH  
 Type of heating = Direct

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

# PLANT DESCRIPTIONS

Plant : Typical building 5,elect

05-02-91

Prepared By : E A C

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

\*\*\*\*\*

## 1 PLANT NAME AND TYPES

Class = Heat Pumps  
Name = Typical building 5,elect  
Heat Pump Type = Air Source Heat Pump  
Auxiliary Plant Type = Electrical Resistance

\*\*\*\*\*

## 2 AIR SYSTEM SELECTION

Air System Name	Mult	Air System Name	Mult
Typical building 5	1		

\*\*\*\*\*

## 3 PLANT CHARACTERISTICS (Air Source Heat Pump)

### COOLING DATA

Estimated maximum cooling coil load = 5.27 Ton  
Capacity at 95.0 F outdoor air = 6.00 Ton  
Input power rate at 95.0 F outdoor air = 1.200 kW/Ton

### HEATING DATA

Estimated maximum heating coil load = 70.15 MBH  
Capacity at 47.0 F outdoor air = 72.0 MBH  
Compressor, evaporator fan kW at 47.0 F outdoor air = 7.5 kW  
Outdoor air temperature for cutoff = 15.0 F

### AUXILIARY PLANT DATA

Plant type = Electrical  
Estimated maximum heating coil load = 70.15 MBH  
Type of heating = Direct

\*\*\*\*\*

## 4 PUMP SYSTEM DATA

(No inputs required)

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 1,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

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 6100190202

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\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	18951 kWh	65	0.011	47.4 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		65	0.011	47.4 %
Non-HVAC Component				
Electric	21068 kWh	72	0.012	52.6 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		72	0.012	52.6 %
*****				
>>> GRAND TOTAL		137	0.024	100.0 %
*****				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,808 sqft  
 Conditioned floor area = 5,808 sqft

\*\*\*\*\*



## ANNUAL COMPONENT COSTS

Building : Typical building 1,elect

05-02-91

Site : Washington, Dist. of Columbia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	5	0.001	3.8 %
Cooling Plants	24	0.004	17.6 %
Heating Plants	35	0.006	26.0 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	65	0.011	47.4 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	72	0.012	52.6 %
>>> Non-HVAC Sub-total	72	0.012	52.6 %
>>> GRAND TOTAL	137	0.024	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
building floor area. For this building:

Gross floor area = 5,808 sqft

Conditioned floor area = 5,808 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 2,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-02-91  
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Carrier Hourly Analysis Program

\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	20184 kWh	69	0.019	65.7 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		69	0.019	65.7 %
Non-HVAC Component				
Electric	10534 kWh	36	0.010	34.3 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		36	0.010	34.3 %
=====				
>>> GRAND TOTAL		105	0.028	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 3,704 sqft  
 Conditioned floor area = 3,704 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 2,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

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 6100190202

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	3	0.001	2.9 %
Cooling Plants	14	0.004	13.3 %
Heating Plants	52	0.014	49.5 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	69	0.019	65.7 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	36	0.010	34.3 %
>>> Non-HVAC Sub-total	36	0.010	34.3 %
>>> GRAND TOTAL	105	0.028	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 3,704 sqft  
 Conditioned floor area = 3,704 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 3,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

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 6100190202

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	6	0.001	3.7 %
Cooling Plants	26	0.004	16.9 %
Heating Plants	52	0.007	33.1 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	84	0.011	53.7 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	72	0.010	46.3 %
>>> Non-HVAC Sub-total	72	0.010	46.3 %
>>> GRAND TOTAL	155	0.021	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 7,408 sqft  
 Conditioned floor area = 7,408 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 3,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

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Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	24482 kWh	84	0.011	53.7 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		84	0.011	53.7 %
Non-HVAC Component				
Electric	21068 kWh	72	0.010	46.3 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		72	0.010	46.3 %
=====				
>>> GRAND TOTAL		155	0.021	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 7,408 sqft  
 Conditioned floor area = 7,408 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 4,elect

05-02-91

Site : Washington, Dist. of Columbia

6100190202

Prepared By : E A C

Carrier Hourly Analysis Program

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\*\*\*\*\*

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	4	0.001	5.3 %
Cooling Plants	21	0.005	24.3 %
Heating Plants	23	0.006	27.8 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	48	0.012	57.4 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	36	0.009	42.6 %
>>> Non-HVAC Sub-total	36	0.009	42.6 %
>>> GRAND TOTAL	84	0.020	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
building floor area. For this building:

Gross floor area = 4,146 sqft

Conditioned floor area = 4,146 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 4,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-02-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	14202 kWh	48	0.012	57.4 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		48	0.012	57.4 %

Non-HVAC Component

Electric	10534 kWh	36	0.009	42.6 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		36	0.009	42.6 %

=====  
 >>> GRAND TOTAL 84 0.020 100.0 %  
 =====

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,146 sqft  
 Conditioned floor area = 4,146 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 5,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-02-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	4	0.001	3.8 %
Cooling Plants	20	0.004	17.2 %
Heating Plants	39	0.007	33.0 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	63	0.011	53.9 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	54	0.010	46.1 %
>>> Non-HVAC Sub-total	54	0.010	46.1 %
>>> GRAND TOTAL	117	0.021	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,556 sqft  
 Conditioned floor area = 5,556 sqft

\*\*\*\*\*



## ANNUAL ENERGY COSTS

Building : Typical building 5,elect  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-02-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	18506 kWh	63	0.011	53.9 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		63	0.011	53.9 %
Non-HVAC Component				
Electric	15801 kWh	54	0.010	46.1 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		54	0.010	46.1 %
*****				
>>> GRAND TOTAL		117	0.021	100.0 %
*****				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:  
 Gross floor area = 5,556 sqft  
 Conditioned floor area = 5,556 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 1, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	5	0.001	2.4 %
Cooling Plants	16	0.003	7.4 %
Heating Plants	100	0.017	47.5 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	121	0.021	57.4 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	90	0.015	42.6 %
>>> Non-HVAC Sub-total	90	0.015	42.6 %
>>> GRAND TOTAL	211	0.036	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,808 sqft  
 Conditioned floor area = 5,808 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 1, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

05-03-91  
 6100190202

Page 1 of 1

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	6066 kWh	21	0.004	9.8 %
Natural Gas	1002 Therms	100	0.017	47.5 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		121	0.021	57.4 %

Non-HVAC Component

Electric	0 kWh	0	0.000	0.0 %
Natural Gas	899 Therms	90	0.015	42.6 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		90	0.015	42.6 %

=====  
 >>> GRAND TOTAL 211 0.036 100.0 %  
 =====

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,808 sqft  
 Conditioned floor area = 5,808 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 2, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

05-03-91  
 6100190202

Page 1 of 1

TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	3	0.001	2.3 %
Cooling Plants	9	0.003	7.1 %
Heating Plants	74	0.020	56.3 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	86	0.023	65.7 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	45	0.012	34.3 %
>>> Non-HVAC Sub-total	45	0.012	34.3 %
>>> GRAND TOTAL	131	0.035	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 3,704 sqft

Conditioned floor area = 3,704 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 2, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C  
 Carrier Hourly Analysis Program

05-03-91  
 6100190202

Page 1 of 1

\*\*\*\*\*  
 TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	3626 kWh	12	0.003	9.4 %
Natural Gas	738 Therms	74	0.020	56.3 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		86	0.023	65.7 %
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	449 Therms	45	0.012	34.3 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		45	0.012	34.3 %
=====				
>>> GRAND TOTAL		131	0.035	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 3,704 sqft  
 Conditioned floor area = 3,704 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 3, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	6	0.001	2.2 %
Cooling Plants	17	0.002	6.7 %
Heating Plants	148	0.020	56.7 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	171	0.023	65.6 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	90	0.012	34.4 %
>>> Non-HVAC Sub-total	90	0.012	34.4 %
>>> GRAND TOTAL	261	0.035	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 7,408 sqft  
 Conditioned floor area = 7,408 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 3, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Carrier Hourly Analysis Program

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	6795 kWh	23	0.003	8.9 %
Natural Gas	1479 Therms	148	0.020	56.7 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		171	0.023	65.6 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	899 Therms	90	0.012	34.4 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		90	0.012	34.4 %
-----				
>>> GRAND TOTAL		261	0.035	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 7,408 sqft  
 Conditioned floor area = 7,408 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 4, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	4	0.001	3.0 %
Cooling Plants	14	0.003	9.3 %
Heating Plants	86	0.021	57.7 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	105	0.025	70.0 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	45	0.011	30.0 %
>>> Non-HVAC Sub-total	45	0.011	30.0 %
>>> GRAND TOTAL	150	0.036	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 4,146 sqft  
 Conditioned floor area = 4,146 sqft

\*\*\*\*\*



## ANNUAL ENERGY COSTS

Building : Typical building 4, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * -->		% of Total
		(MBTU)	(MBTU/sqft)	
Electric	5388 kWh	18	0.004	12.3 %
Natural Gas	863 Therms	86	0.021	57.7 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		105	0.025	70.0 %
-----				
Non-HVAC Component				
Electric	0 kWh	0	0.000	0.0 %
Natural Gas	449 Therms	45	0.011	30.0 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		45	0.011	30.0 %
-----				
>>> GRAND TOTAL		150	0.036	100.0 %
=====				

\* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 4,146 sqft

Conditioned floor area = 4,146 sqft

\*\*\*\*\*

## ANNUAL COMPONENT COSTS

Building : Typical building 5, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91  
 6100190202

Page 1 of 1

Carrier Hourly Analysis Program

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TABLE 1. COSTS BY COMPONENT

Component	<---- Annual Costs * ---->		% of Total
	(MBTU)	(MBTU/sqft)	
Air System Fans	4	0.001	2.2 %
Cooling Plants	13	0.002	6.8 %
Heating Plants	111	0.020	56.6 %
Pumps	0	0.000	0.0 %
>>> HVAC Subtotal	129	0.023	65.6 %
Lights	0	0.000	0.0 %
Other Electric	0	0.000	0.0 %
Miscellaneous Electric	0	0.000	0.0 %
Domestic Hot Water	67	0.012	34.4 %
>>> Non-HVAC Sub-total	67	0.012	34.4 %
>>> GRAND TOTAL	196	0.035	100.0 %

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,556 sqft

Conditioned floor area = 5,556 sqft

\*\*\*\*\*

## ANNUAL ENERGY COSTS

Building : Typical building 5, gas  
 Site : Washington, Dist. of Columbia  
 Prepared By : E A C

05-03-91

6100190202

Carrier Hourly Analysis Program

Page 1 of 1

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	<---- Annual Costs * --> (MBTU) (MBTU/sqft)		% of Total
Electric	5204 kWh	18	0.003	9.1 %
Natural Gas	1109 Therms	111	0.020	56.6 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
>>> HVAC Subtotal		129	0.023	65.6 %

## Non-HVAC Component

Electric	0 kWh	0	0.000	0.0 %
Natural Gas	674 Therms	67	0.012	34.4 %
Fuel Oil	0 gallon	0	0.000	0.0 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
>>> Non-HVAC Subtotal		67	0.012	34.4 %

=====

>>> GRAND TOTAL		196	0.035	100.0 %
-----------------	--	-----	-------	---------

=====

\* Note: 1. Cost per unit floor area is based on the gross  
 building floor area. For this building:

Gross floor area = 5,556 sqft  
 Conditioned floor area = 5,556 sqft

\*\*\*\*\*

2600 AREA (WOODLAWN VILLAGE)

**Fuel Conversion:**

Description - Existing heat pumps and electric water heaters are proposed to be replaced by gas-fired boilers and water heaters respectively.

Energy Saved	= -9,391	MBTU/year
Cost	= \$1,864,793	(incl. SIOH)
SIR	= 0.72	

PORT BELVOIR WOODLAWN HOUSING AREA

CONSTRUCTION COSTS AND ENERGY SAVINGS CONSOLIDATION

TYPE	No.	ENERGY SAVINGS, MBTU/BLDG			TOTAL ENERGY SAVINGS, MBTU		
		ELEC.	OIL	GAS	ELEC.	OIL	GAS
1	50	137	0	-211	6850	0	-10550
2	34	105	0	-131	3570	0	-4454
3	16	155	0	-261	2480	0	-4176
4	22	84	0	-150	1848	0	-3300
5	21	117	0	-196	2457	0	-4116
TOTAL	143				17205	0	-26596

**ENGINEERING ANALYSIS**

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

**WOODLAWN VILLAGE - TYPE 1 (50 buildings)**

**Proposed conversion**

Estimated cost of gas-fired furnace		= \$ 11,058
Estimated cost of gas-fired water heater		= \$ 2,335
Cost of conversion now		= \$ 13,393
Total Cost of Conversion	\$13,393 X 50	= \$669,650

**Water heater replacement costs**

Gas-fired water heaters	= \$2,335 X 50	= \$116,750
Electric water heaters	= \$2,078 X 50	= \$103,900

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 1  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace heat pumps with new gas furnaces

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Remove heat pump	4	each	\$200	\$800	---	---	\$800
Install gas furnace							
Gas furnaces w/ controls	4	each	\$88	\$352	\$390	\$1,560	\$1,912
Pres. reg., valves, etc.	4	each	\$85	\$340	\$160	\$640	\$980
Gas piping	120	l.f.	\$3.21	\$385	\$0.87	\$104	\$490
Holes thru walls	8	each	\$54	\$432	---	---	\$432
Install gas vent chimney							
Gas double wall, galv., 6"	96	v.l.f.	\$3.96	\$380	\$5.85	\$562	\$942
Elbow 90, 6"	4	each	\$16.45	\$66	\$11.70	\$47	\$113
Roof flashing	4	each	\$8.55	\$34	\$11.70	\$47	\$81
Tee, 6"	4	each	\$17.40	\$70	\$14.60	\$58	\$128
Tee cap, 6"	4	each	\$1.75	\$7	\$9.50	\$38	\$45
Top cap, 6"	4	each	\$9.85	\$39	\$8.75	\$35	\$74
Architectual modification							
Core drill floor/ceil./roof	4	each	\$51.30	\$205	---	---	\$205
2x4 wood framing @ 16"	384	s.f.	\$1.08	\$415	\$0.42	\$161	\$576
5/3" type x gypsum wallbd.	384	s.f.	\$1.08	\$415	\$0.28	\$108	\$522
Painting	800	s.f.	\$0.60	\$480	\$0.16	\$128	\$608
Patch roofing	4	each	\$24.70	\$99	\$6.35	\$25	\$124
SUB-TOTAL:				\$4,519		\$3,513	\$8,032
Labor Markup: 21%				\$949		---	\$949
Taxes: 4.5%				---		\$158	\$158
SUB-TOTAL:				\$5,468		\$3,671	\$9,139
Overhead: 10%				\$547		\$367	\$914
SUB-TOTAL:				\$6,015		\$4,038	\$10,053
Profit: 10%				\$601		\$404	\$1,005
TOTAL:				\$6,616		\$4,442	\$11,058

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 1  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing water heaters with gas water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	4	each	\$110	\$440	\$230	\$920	\$1,360
Remove water heater	4	each	\$90	\$360	---	---	\$360
as double wall, galv., 4"	40	v.l.f.	\$5.15	\$206	\$2.86	\$114	\$320
Elbow 90, 4"	4	each	\$16.45	\$66	\$11.70	\$47	\$113
Tee, 6"	4	each	\$17.40	\$70	\$14.60	\$58	\$128
Tee cap, 6"	4	each	\$1.75	\$7	\$9.50	\$38	\$45
SUB-TOTAL:				\$800		\$920	\$1,720
Labor Markup: 21%				\$168		---	\$168
Taxes: 4.5%				---		\$41	\$41
SUB-TOTAL:				\$968		\$961	\$1,929
Overhead: 10%				\$97		\$96	\$193
SUB-TOTAL:				\$1,065		\$1,058	\$2,122
Profit: 10%				\$106		\$106	\$212
TOTAL:				\$1,171		\$1,163	\$2,335



# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 1  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing electric water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	4	each	\$99	\$396	\$192	\$768	\$1,164
Remove water heater	4	each	\$90	\$360	---	---	\$360
SUB-TOTAL:				\$756		\$768	\$1,524
labor Markup: 21%				\$159		---	\$159
Taxes: 4.5%				---		\$35	\$35
SUB-TOTAL:				\$915		\$803	\$1,717
Overhead: 10%				\$91		\$80	\$172
SUB-TOTAL:				\$1,006		\$883	\$1,889
Profit: 10%				\$101		\$88	\$189
TOTAL:				\$1,107		\$971	\$2,078

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

FUEL CONVERSION COST ANALYSIS

WOODLAWN VILLAGE - TYPE 2 (34 buildings)

Proposed conversion

Estimated cost of gas-fired furnace		= \$ 5,529
Estimated cost of gas-fired water heater		= \$ 1,686
Cost of conversion now		= \$ 7,215
Total Cost of Conversion	\$7,215 X 34	= \$245,310

Water heater replacement costs

Gas-fired water heaters	= \$1,686 X 34	= \$ 57,324
Electric water heaters	= \$1,393 X 34	= \$ 47,362

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 2  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace heat pumps with new gas furnaces

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Remove heat pump	2	each	\$200	\$400	---	---	\$400
Install gas furnace							
Gas furnaces w/ controls	2	each	\$88	\$176	\$390	\$780	\$956
Pres. reg., valves, etc.	2	each	\$85	\$170	\$160	\$320	\$490
Gas piping	60	l.f.	\$3.21	\$193	\$0.87	\$52	\$245
Holes thru walls	4	each	\$54	\$216	---	---	\$216
Install gas vent chimney							
Gas double wall, galv., 6"	48	v.l.f.	\$3.96	\$190	\$5.85	\$281	\$471
Elbow 90, 6"	2	each	\$16.45	\$33	\$11.70	\$23	\$56
Roof flashing	2	each	\$8.55	\$17	\$11.70	\$23	\$41
Tee, 6"	2	each	\$17.40	\$35	\$14.60	\$29	\$64
Tee cap, 6"	2	each	\$1.75	\$4	\$9.50	\$19	\$23
Top cap, 6"	2	each	\$9.85	\$20	\$8.75	\$18	\$37
Architectual modification							
Core drill floor/ceil./roof	2	each	\$51.30	\$103	---	---	\$103
2x4 wood framing @ 16"	192	s.f.	\$1.08	\$207	\$0.42	\$81	\$288
5/3" type x gypsum wallbd.	192	s.f.	\$1.08	\$207	\$0.28	\$54	\$261
Painting	400	s.f.	\$0.60	\$240	\$0.16	\$64	\$304
Patch roofing	2	each	\$24.70	\$49	\$6.35	\$13	\$62
SUB-TOTAL:				\$2,259		\$1,757	\$4,016
Labor Markup: 21%				\$474		---	\$474
Taxes: 4.5%				---		\$79	\$79
SUB-TOTAL:				\$2,734		\$1,836	\$4,570
Overhead: 10%				\$273		\$184	\$457
SUB-TOTAL:				\$3,007		\$2,019	\$5,026
Profit: 10%				\$301		\$202	\$503
TOTAL:				\$3,308		\$2,221	\$5,529

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 2  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing water heaters with gas water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	2	each	\$130	\$260	\$412	\$824	\$1,084
Remove water heater	2	each	\$90	\$180	---	---	\$180
as double wall, galv., 4"	20	v.l.f.	\$5.15	\$103	\$2.86	\$57	\$160
Elbow 90, 4"	2	each	\$16.45	\$33	\$11.70	\$23	\$56
Tee, 6"	2	each	\$17.40	\$35	\$14.60	\$29	\$64
Tee cap, 6"	2	each	\$1.75	\$4	\$9.50	\$19	\$23
SUB-TOTAL:				\$440		\$824	\$1,264
Labor Markup: 21%				\$92		---	\$92
Taxes: 4.5%				---		\$37	\$37
SUB-TOTAL:				\$532		\$861	\$1,393
Overhead: 10%				\$53		\$86	\$139
SUB-TOTAL:				\$586		\$947	\$1,533
Profit: 10%				\$59		\$95	\$153
TOTAL:				\$644		\$1,042	\$1,686

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 2  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing electric water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	2	each	\$125	\$250	\$302	\$604	\$854
Remove water heater	2	each	\$90	\$180	---	---	\$180
SUB-TOTAL:				\$430		\$604	\$1,034
Labor Markup: 21%				\$90		---	\$90
Taxes: 4.5%				---		\$27	\$27
SUB-TOTAL:				\$520		\$631	\$1,151
Overhead: 10%				\$52		\$63	\$115
SUB-TOTAL:				\$572		\$694	\$1,267
Profit: 10%				\$57		\$69	\$127
TOTAL:				\$630		\$764	\$1,393

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

FUEL CONVERSION COST ANALYSIS

WOODLAWN VILLAGE - TYPE 3 (16 buildings)

Proposed conversion

Estimated cost of gas-fired furnace		= \$ 11,058
Estimated cost of gas-fired water heater		= \$ 3,372
Cost of conversion now		= \$ 14,430
Total Cost of Conversion	\$14,430 X 16	= \$230,880

Water heater replacement costs

Gas-fired water heaters	= \$3,372 X 16	= \$ 53,952
Electric water heaters	= \$2,787 X 16	= \$ 44,592

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 3  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace heat pumps with new gas furnaces

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Remove heat pump	4	each	\$200	\$800	---	---	\$800
Install gas furnace							
Gas furnaces w/ controls	4	each	\$88	\$352	\$390	\$1,560	\$1,912
Pres. reg., valves, etc.	4	each	\$85	\$340	\$160	\$640	\$980
Gas piping	120	l.f.	\$3.21	\$385	\$0.87	\$104	\$490
Holes thru walls	8	each	\$54	\$432	---	---	\$432
Install gas vent chimney							
Gas double wall, galv., 6"	96	v.l.f.	\$3.96	\$380	\$5.85	\$562	\$942
Elbow 90, 6"	4	each	\$16.45	\$66	\$11.70	\$47	\$113
Roof flashing	4	each	\$8.55	\$34	\$11.70	\$47	\$81
Tee, 6"	4	each	\$17.40	\$70	\$14.60	\$58	\$128
Tee cap, 6"	4	each	\$1.75	\$7	\$9.50	\$38	\$45
Top cap, 6"	4	each	\$9.85	\$39	\$8.75	\$35	\$74
Architectual modification							
Core drill floor/ceil./roof	4	each	\$51.30	\$205	---	---	\$205
2x4 wood framing @ 16"	384	s.f.	\$1.08	\$415	\$0.42	\$161	\$576
5/3" type x gypsum wallbd.	384	s.f.	\$1.08	\$415	\$0.28	\$108	\$522
Painting	800	s.f.	\$0.60	\$480	\$0.16	\$128	\$608
Patch roofing	4	each	\$24.70	\$99	\$6.35	\$25	\$124
SUB-TOTAL:				\$4,519		\$3,513	\$8,032
Labor Markup: 21%				\$949		---	\$949
Taxes: 4.5%				---		\$158	\$158
SUB-TOTAL:				\$5,468		\$3,671	\$9,139
Overhead: 10%				\$547		\$367	\$914
SUB-TOTAL:				\$6,015		\$4,038	\$10,053
Profit: 10%				\$601		\$404	\$1,005
TOTAL:				\$6,616		\$4,442	\$11,058

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 3  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing water heaters with gas water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	4	each	\$130	\$520	\$412	\$1,648	\$2,168
Remove water heater	4	each	\$90	\$360	---	---	\$360
as double wall, galv., 4"	40	v.l.f.	\$5.15	\$206	\$2.86	\$114	\$320
Elbow 90, 4"	4	each	\$16.45	\$66	\$11.70	\$47	\$113
Tee, 6"	4	each	\$17.40	\$70	\$14.60	\$58	\$128
Tee cap, 6"	4	each	\$1.75	\$7	\$9.50	\$38	\$45
SUB-TOTAL:				\$880		\$1,648	\$2,528
Labor Markup: 21%				\$185		---	\$185
Taxes: 4.5%				---		\$74	\$74
SUB-TOTAL:				\$1,065		\$1,722	\$2,787
Overhead: 10%				\$106		\$172	\$279
SUB-TOTAL:				\$1,171		\$1,894	\$3,066
Profit: 10%				\$117		\$189	\$307
TOTAL:				\$1,288		\$2,084	\$3,372



# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 3  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing electric water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	4	each	\$125	\$500	\$302	\$1,208	\$1,708
Remove water heater	4	each	\$90	\$360	---	---	\$360
SUB-TOTAL:				\$860		\$1,208	\$2,068
Labor Markup: 21%				\$181		---	\$181
Taxes: 4.5%				---		\$54	\$54
SUB-TOTAL:				\$1,041		\$1,262	\$2,303
Overhead: 10%				\$104		\$126	\$230
SUB-TOTAL:				\$1,145		\$1,389	\$2,533
Profit: 10%				\$114		\$139	\$253
TOTAL:				\$1,259		\$1,527	\$2,787

**ENGINEERING ANALYSIS**

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

**WOODLAWN VILLAGE - TYPE 4 (22 buildings)**

**Proposed conversion**

Estimated cost of gas-fired furnace	= \$	5,529
Estimated cost of gas-fired water heater	= \$	1,686
Cost of conversion now	= \$	7,215
Total Cost of Conversion	\$7,215 X 22	= \$158,730

**Water heater replacement costs**

Gas-fired water heaters	= \$1,686 X 22	= \$ 37,092
Electric water heaters	= \$1,393 X 22	= \$ 30,646

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 4  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace heat pumps with new gas furnaces

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Remove heat pump	2	each	\$200	\$400	---	---	\$400
Install gas furnace							
Gas furnaces w/ controls	2	each	\$88	\$176	\$390	\$780	\$956
Pres. reg., valves, etc.	2	each	\$85	\$170	\$160	\$320	\$490
Gas piping	60	l.f.	\$3.21	\$193	\$0.87	\$52	\$245
Holes thru walls	4	each	\$54	\$216	---	---	\$216
Install gas vent chimney							
Gas double wall, galv., 6"	48	v.l.f.	\$3.96	\$190	\$5.85	\$281	\$471
Elbow 90, 6"	2	each	\$16.45	\$33	\$11.70	\$23	\$56
Roof flashing	2	each	\$8.55	\$17	\$11.70	\$23	\$41
Tee, 6"	2	each	\$17.40	\$35	\$14.60	\$29	\$64
Tee cap, 6"	2	each	\$1.75	\$4	\$9.50	\$19	\$23
Top cap, 6"	2	each	\$9.85	\$20	\$8.75	\$18	\$37
Architectural modification							
Core drill floor/ceil./roof	2	each	\$51.30	\$103	---	---	\$103
2x4 wood framing @ 16"	192	s.f.	\$1.08	\$207	\$0.42	\$81	\$288
5/3" type x gypsum wallbd.	192	s.f.	\$1.08	\$207	\$0.28	\$54	\$261
Painting	400	s.f.	\$0.60	\$240	\$0.16	\$64	\$304
Patch roofing	2	each	\$24.70	\$49	\$6.35	\$13	\$62
SUB-TOTAL:				\$2,259		\$1,757	\$4,016
Labor Markup: 21%				\$474		---	\$474
Taxes: 4.5%				---		\$79	\$79
SUB-TOTAL:				\$2,734		\$1,836	\$4,570
Overhead: 10%				\$273		\$184	\$457
SUB-TOTAL:				\$3,007		\$2,019	\$5,026
Profit: 10%				\$301		\$202	\$503
TOTAL:				\$3,308		\$2,221	\$5,529

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 4  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing water heaters with gas water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	2	each	\$130	\$260	\$412	\$824	\$1,084
Remove water heater	2	each	\$90	\$180	---	---	\$180
as double wall, galv., 4"	20	v.l.f.	\$5.15	\$103	\$2.86	\$57	\$160
Elbow 90, 4"	2	each	\$16.45	\$33	\$11.70	\$23	\$56
Tee, 6"	2	each	\$17.40	\$35	\$14.60	\$29	\$64
Tee cap, 6"	2	each	\$1.75	\$4	\$9.50	\$19	\$23
SUB-TOTAL:				\$440		\$824	\$1,264
Labor Markup: 21%				\$92		---	\$92
Taxes: 4.5%				---		\$37	\$37
SUB-TOTAL:				\$532		\$861	\$1,393
Overhead: 10%				\$53		\$86	\$139
SUB-TOTAL:				\$586		\$947	\$1,533
Profit: 10%				\$59		\$95	\$153
TOTAL:				\$644		\$1,042	\$1,686

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 4  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing electric water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	2	each	\$125	\$250	\$302	\$604	\$854
Remove water heater	2	each	\$90	\$180	---	---	\$180
SUB-TOTAL:				\$430		\$604	\$1,034
Labor Markup: 21%				\$90		---	\$90
Taxes: 4.5%				---		\$27	\$27
SUB-TOTAL:				\$520		\$631	\$1,151
Overhead: 10%				\$52		\$63	\$115
SUB-TOTAL:				\$572		\$694	\$1,267
Profit: 10%				\$57		\$69	\$127
TOTAL:				\$630		\$764	\$1,393

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

FUEL CONVERSION COST ANALYSIS

WOODLAWN VILLAGE - TYPE 5 (21 buildings)

Proposed conversion

Estimated cost of gas-fired furnace	= \$	8,294
Estimated cost of gas-fired water heater	= \$	2,529
Cost of conversion now	= \$	10,823
Total Cost of Conversion	\$10,823 X 21	= \$227,283

Water heater replacement costs

Gas-fired water heaters	= \$2,529 X 21	= \$ 53,109
Electric water heaters	= \$2,090 X 21	= \$ 43,890

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 5  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace heat pumps with new gas furnaces

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Remove heat pump	3	each	\$200	\$600	---	---	\$600
Install gas furnace							
Gas furnaces w/ controls	3	each	\$88	\$264	\$390	\$1,170	\$1,434
Pres. reg., valves, etc.	3	each	\$85	\$255	\$160	\$480	\$735
Gas piping	90	l.f.	\$3.21	\$289	\$0.87	\$78	\$367
Holes thru walls	6	each	\$54	\$324	---	---	\$324
Install gas vent chimney							
Gas double wall, galv., 6"	72	v.l.f.	\$3.96	\$285	\$5.85	\$421	\$706
Elbow 90, 6"	3	each	\$16.45	\$49	\$11.70	\$35	\$84
Roof flashing	3	each	\$8.55	\$26	\$11.70	\$35	\$61
Tee, 6"	3	each	\$17.40	\$52	\$14.60	\$44	\$96
Tee cap, 6"	3	each	\$1.75	\$5	\$9.50	\$29	\$34
Top cap, 6"	3	each	\$9.85	\$30	\$8.75	\$26	\$56
Architectual modification							
Core drill floor/ceil./roof	3	each	\$51.30	\$154	---	---	\$154
2x4 wood framing @ 16"	288	s.f.	\$1.08	\$311	\$0.42	\$121	\$432
5/3" type x gypsum wallbd.	288	s.f.	\$1.08	\$311	\$0.28	\$81	\$392
Painting	600	s.f.	\$0.60	\$360	\$0.16	\$96	\$456
Patch roofing	3	each	\$24.70	\$74	\$6.35	\$19	\$93
SUB-TOTAL:				\$3,389		\$2,635	\$6,024
Labor Markup: 21%				\$712		---	\$712
Taxes: 4.5%				---		\$119	\$119
SUB-TOTAL:				\$4,101		\$2,753	\$6,854
Overhead: 10%				\$410		\$275	\$685
SUB-TOTAL:				\$4,511		\$3,029	\$7,540
Profit: 10%				\$451		\$303	\$754
TOTAL:				\$4,962		\$3,332	\$8,294

# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 5  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing water heaters with gas water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	3	each	\$130	\$390	\$412	\$1,236	\$1,626
Remove water heater	3	each	\$90	\$270	---	---	\$270
as double wall, galv., 4"	30	v.l.f.	\$5.15	\$155	\$2.86	\$86	\$240
Elbow 90, 4"	3	each	\$16.45	\$49	\$11.70	\$35	\$84
Tee, 6"	3	each	\$17.40	\$52	\$14.60	\$44	\$96
Tee cap, 6"	3	each	\$1.75	\$5	\$9.50	\$29	\$34
SUB-TOTAL:				\$660		\$1,236	\$1,896
Labor Markup: 21%				\$139		---	\$139
Taxes: 4.5%				---		\$56	\$56
SUB-TOTAL:				\$799		\$1,292	\$2,090
Overhead: 10%				\$80		\$129	\$209
SUB-TOTAL:				\$878		\$1,421	\$2,299
Profit: 10%				\$88		\$142	\$230
TOTAL:				\$966		\$1,563	\$2,529



# CONSTRUCTION COST ESTIMATE

PROJECT: ENERGY SAVINGS OPPORTUNITY SURVEY

LOCATION: Typical building 5  
Woodlawn Village  
Fort Belvoir, VA

BY: Engineering Applications Consultants

Replace existing electric water heaters

ITEM	QUANTITY		LABOR		MATERIAL		TOTAL COST
	Number	Unit	Per unit	Total	Per unit	Total	
Install water heater	3	each	\$125	\$375	\$302	\$906	\$1,281
Remove water heater	3	each	\$90	\$270	---	---	\$270
SUB-TOTAL:				\$645		\$906	\$1,551
Labor Markup: 21%				\$135		---	\$135
Taxes: 4.5%				---		\$41	\$41
SUB-TOTAL:				\$780		\$947	\$1,727
Overhead: 10%				\$78		\$95	\$173
SUB-TOTAL:				\$858		\$1,041	\$1,900
Profit: 10%				\$86		\$104	\$190
TOTAL:				\$944		\$1,146	\$2,090

<b>CONSTRUCTION COST ESTIMATE</b>				DATE PREPARED <b>AUG '91</b>		SHEET <b>1</b> OF <b>1</b>		
PROJECT <b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>				BASIS FOR ESTIMATE <input type="checkbox"/> CODE A (No design completed) <input type="checkbox"/> CODE B (Preliminary design) <input type="checkbox"/> CODE C (Final design) <input type="checkbox"/> OTHER (Specify) _____				
LOCATION <b>FT. BELVOIR, VIRGINIA</b>								
ARCHITECT ENGINEER <b>ENGINEERING APPLICATIONS CONSULTANTS</b>								
DRAWING NO. <b>WOODLAWN VILLAGE</b>			ESTIMATOR <b>REF</b>		CHECKED BY <b>VP</b>			
<u>GAS to BLDGS</u> SUMMARY		QUANTITY		LABOR		MATERIAL		TOTAL COST
		NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	
TRENCH & BACKFILL								
	11,000	LF	1.01	11,110	.74	8,140	19,250	
HAND EXCAVATING								
	1400	CY	34.00	47,600		-	47,600	
HAND BACKFILLING								
	1400	CY	12.45	17,430		-	17,430	
POLYETHYLENE PIPE - 1 1/4"								
	11,000	LF	1.17	12,870	.55	6050	18,920	
BLACK STEEL PIPE - 3/4"								
	1000	LF	3.21	3,210	.87	870	4,080	
MAIN CONNECTIONS								
	444	EA	15.00	6,660	5.00	2220	8,880	
STOP VALVES - 3/4"								
	444	EA	9.00	3,996	8.05	3574	7,570	
PRESSURE REGULATORS								
	444	EA	10.00	4,440	50.00	22,200	26,640	
SIDEWALK REPAIR								
	2000	SF	.94	1,880	1.26	2,520	4,400	
PAVEMENT REMOVAL								
	200	SY	1.84	368	2.56	512	880	
DISPOSAL OF MATERIALS								
		LS		1,000		-	1,000	
MATERIAL HANDL./STORAGE								
		LS		1,000		-	1,000	
SEED & SOD								
		LS		750		-	750	
GAS LINE TESTING								
	444	EA	10.00	4,444		-	4,444	
GENERAL CLEAN-UP								
	444	EA	10.00	4,444		-	4,444	
SUB-TOTAL								
				121,202		46,086	167,288	
LABOR, INS. & TAXES 21%								
				25,452		-	25,452	
SALES TAX 4.5%								
				-		2,074	2,074	
SUB-TOTAL								
				146,654		48,160	194,814	
OVERHEAD 10%								
							19,481	
SUB-TOTAL								
							214,294	
PROFIT 10%								
							21,429	
SUB-TOTAL								
							235,723	
TOTAL								
							235,723	

$$\text{PROPORTIONATE COST / UNIT} = \frac{89 \times 235,723}{444} = \$531.$$

ENGINEERING ANALYSIS

Sheet \_\_\_\_\_ of \_\_\_\_\_

By \_\_\_\_\_

Project: ESOS, FORT BELVOIR, VIRGINIA Date: August 29, 1991

Contract No: DACA 31-89-C-0198 EAC Project No. 89034.01

**FUEL CONVERSION COST ANALYSIS**

WOODLAWN VILLAGE - SUMMARY OF COSTS

Type 1 (50 buildings)	\$ 669,650
Type 2 (34 buildings)	\$ 245,310
Type 3 (16 buildings)	\$ 230,880
Type 4 (22 buildings)	\$ 158,730
Type 5 (21 buildings)	\$ 227,283
Cost to Govt for curb to building gas lines	\$ 235,723
<b>TOTAL</b>	<b>\$1,767,576</b>

Replacement costs of water heaters:

	<u>Gas-fired</u>	<u>Electric</u>
Type 1 (50 buildings)	\$116,750	\$103,900
Type 2 (34 buildings)	\$ 57,324	\$ 47,362
Type 3 (16 buildings)	\$ 53,952	\$ 44,592
Type 4 (22 buildings)	\$ 37,092	\$ 30,646
Type 5 (21 buildings)	\$ 53,109	\$ 43,890
Total	\$318,227	\$270,390

## FORT BELVOIR WOODLAWN HOUSING AREA

## CONSOLIDATION OF OTHER COSTS

TYPE	No.	MAINT. COST PER BLDG	ONE TIME REPL COSTS		MAINT. COSTS	ONE TIME REPL COST	
			\$ PER ELEC. WH	BLDG GAS WH		\$ ELEC. WH	GAS WH
1	50	40	2078	-2335	2000	103900	-116750
2	34	20	1393	-1686	680	47362	-57324
3	16	40	2787	-3372	640	44592	-53952
4	22	20	1393	-1686	440	30646	-37092
5	21	30	2090	-2529	630	43890	-53109
TOTAL	143				4390	270390	-318227

**LIFE CYCLE COST ANALYSIS SUMMARY  
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)**

LOCATION: FORT BELVOIR REGION NO. 3 PROJECT NUMBER DACA-31-89-C-0198

PROJECT TITLE: ENERGY SAVINGS OPPORTUNITY SURVEY FISCAL YR. 199

DISCRETE PORTION NAME WOODLAWN VILLAGE - ELECTRIC TO GAS CONVERSION

ANALYSIS DATE August '91 ECONOMIC LIFE 15 YEARS PREPARED BY EAC

1. INVESTMENT

A. CONSTRUCTION COST	\$ 1,767,576
B. SIOH	\$ 97,217
C. DESIGN COST	\$ 106,055
D. SALVAGE VALUE	-
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	\$ 1,970,848

2. ENERGY SAVINGS (+) / COST (-)  
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

	COST \$/MBTU/YR(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELEC	\$ 18.05	17,205	\$ 310,550	11.11	\$ 3,450,213
B. DIST	\$ 7.43				
C. RESID	\$ 6.62				
D. NG	\$ 5.33	- 26,596	\$ -141,757	14.45	\$ -2,048,384
E. COAL					
F. TOTAL		- 9,391	\$ 168,793		\$ 1,401,829

NONENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	MAINT. \$ 4,390
(2) DISCOUNTED SAVING/COST (3A X 3A1)	10.59 \$ 46,490

B. NONRECURRING SAVINGS (+) / COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCUR.(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAV- INGS(+)-COST(-)(4)
REPL.				
(1) ELEC WH	\$ 270390	10	0.63	\$ 170,346
(2) GAS WH	\$ -318227	10	0.63	\$ -200,483
(3)				
(4) TOTAL	\$ -47,837			\$ -30,137

C. TOTAL NONENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 16,353

D. PROJECT NONENERGY QUALIFICATION TEST

(1) 25% MAX NONENERGY CALC (2F5 x .33)	\$ 462,604
a. IF 3D1 IS = OR > 3C GO TO ITEM 4	
b. IF 3D1 IS < 3C CALC S1R = (2F5+3D1) - 1E =	
c. IF 3D1 IS = > 1 GO TO ITEM 4	
d. IF 3D1 IS < 1 PROJECT DOES NOT QUALIFY	

4. FIRST YEAR DOLLAR SAVINGS 2F3 + 3A + (3B1d ÷ YEARS ECONOMIC LIFE) \$ 169,994

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 1,418,182

6. DISCOUNTED SAVINGS RATION (IF < 1 PROJECT DOES NOT QUALIFY) (S1R) = (5 ÷ 1E) = 0.72

SIMPLE PAY BACK PERIOD = 11.6 years